PROJECT TITLE

PORT WELLER SEARCH & RESCUE STATION
DEMOLITION, RENOVATION AND NEW CONSTRUCTION
ST. CATHARINES, ONTARIO
ISSUED FOR TENDER

PROJECT NUMBER R.079827.001

PROJECT DATE 2021-07-26

Architect:

Structural Engineer:

Mechanical Engineer:

Electrical Engineer:

Civil Engineer:

* Administered by PSPC/Dillon Consulting, see Appendix C

* Administered by PSPC/Dillon Consulting, see Appendix C

* Administered by PSPC/Dillon Consulting, see Appendix C

* Administered by PSPC/Dillon Consulting, see Appendix C

* Administered by PSPC/Dillon Consulting, see Appendix C

Appendix B

1. Mitigation Measures and Report Form, Port Weller Search and Rescue Station, St. Catharines, Ontario.

2. CCGC 13-2020, COVID-19 Canadian Coast Guard Screening Questionnaire.

Appendix C – Environmental Sections Administered by Dillon Consulting

END

* Administered by PSPC/Dillon Consulting, see Appendix C

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Title and description of Work.

.2 Contract Method.

.3 Work by others.

.4 Contractor use of premises.

.5 Partial Owner occupancy.

.6 Special Project Procedures and Requirements.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises all work described by the Contract Documents, including but not limited to demolition, renovation, and new construction of buildings and services, decommissioning of existing septic system (bed and tank), decommissioning of SAN pipe, installation of new septic system, installation of new water treatment system and infrastructure, and new solar energy system at the Port Weller Search and Rescue Station, located in St. Catharines, Ontario; and further identified as Project Number R.079827.001.

1.3 CONTRACT METHOD

.1 Construct Work under lump sum Contract.

1.4 COST BREAKDOWN

.1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating Contract Amount.

.2 Show separately cost of equipment purchased exempt from Ontario Retail Sales Tax under your Ontario Sales Tax license number.

.3 Within 48 hours of acceptance of bid submit a list of Subcontractors.

1.5 WORK BY OTHERS

.1 The Contractor shall for the purpose of the Ontario Occupational Health and Safety Act and Regulations for Construction Projects, and for the duration of the Work of the Contract:

.1 Assume the role of Constructor in accordance with the Authority Having Jurisdictions.

.2 Agree, in the event of two or more Contractors working at the same time and space at the work site, without limiting the General Conditions GC3.7, to the Departmental Representative's order to accept the Departmental Representative's other Contractor's role as Constructor and conform to that Contractor's Site Specific Health and Safety Plan.

1.6 CONTRACTOR USE OF PREMISES

.1 Contractor has unrestricted use of site except as described by the site staging plan on drawing 4/A000 until Substantial Performance.

.2 Access to the Hoop House by staff must be maintained during construction.

.3 Coordinate use of premises under direction of Departmental Representative.

1.7 OWNER OCCUPANCY

.1 Owner may occupy specific areas periodically during entire construction period.

.2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.8 SPECIAL PROJECT PROCEDURES AND REQUIREMENTS

.1 Ontario Regulation 903 - Wells to be followed for well decommissioning operations.

.2 Aboveground storage tank (AST) installations to meet all applicable federal requirements, as well as the National Fire Code requirements.

.3 Ensure project activities and lighting (bright lights) do not interfere with navigation on the waterway. Lights shall not shine into the channel such that it would hinder vision of ships personnel. Lights to face inland or be shielded that the light shoots towards the ground.

.4 Seaway Authority and Canadian Coast Guard to have unfettered access to the pier, wharf and gauge station at all times. Road clearances to remain the same or greater than prior to start of Work to ensure vehicles can still reach Port Weller pier on west side.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END

PART 1 - GENERAL

1.1 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" Work areas, including stairs, ramps or ladders, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

.1 Make arrangements with Departmental Representative to facilitate Work as stated.

.2 Provide for personnel and vehicle access to specific location when required.

.3 Where security is reduced by Work provide temporary means to maintain security.

.4 Closures: protect Work temporarily until permanent enclosures are completed.

1.3 SPECIAL REQUIREMENTS

.1 Submit schedule in accordance with Section 01 32 16.

.2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.3 Keep within limits of Work and avenues of ingress and egress.

1.4 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted. Post signs.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under sections as follows:
- .1 Section 03 30 00 – Cast in Place Concrete.
- .2 Section 05 12 23 – Structural Steel.
- .3 Section 05 21 00 – Steel Joist Framing.
- .4 Section 05 31 00 – Steel Decking.
- .5 Section 31 66 15 – Helical Foundation Piles.

1.2 APPOINTMENT AND PAYMENT

.1 Departmental Representative will appoint and pay for services of testing laboratory except follows:
- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience.
- .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
- .4 Mill tests and certificates of compliance.
- .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

1.3 CONTRACTOR'S RESPONSIBILITIES

.1 Provide labour, equipment and facilities to:
- .1 Provide access to Work for inspection and testing.
- .2 Facilitate inspections and tests.
- .3 Make good Work disturbed by inspection and test.
- .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Departmental Representative 48 hours minimum in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the Work at the call of Departmental Representative.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Unless directed otherwise by Departmental Representative, record minutes of meetings. Minutes shall be circulated to attending parties and affected parties not in attendance within 5 days after meeting.

.7 Representative of Contractor, Subcontractor and Suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include:
.1 Appointment of official representative of participants in the Work.
.2 Schedule of Work: in accordance with Section 01 32 16.
.3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.
.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
.5 Site security in accordance with Section 01 52 00.
.6 Health and safety in accordance with Section 01 35 29.
.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, administrative requirements.

.8 Record drawings and specifications in accordance with Sections 01 33 00 and 01 78 00.
.9 Maintenance manuals in accordance with Section 01 78 00.
.10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
.11 Monthly progress claims, administrative procedures, photographs, hold backs.
.12 Appointment of inspection and testing agencies or firms.
.13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and 2 weeks prior to project completion, schedule progress meetings biweekly.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.

.3 Notify parties minimum 10 days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 days after meeting.

.5 Agenda to include the following:
.1 Review, approval of minutes of previous meeting.
.2 Review of Work progress since previous meeting.
.3 Field observations, problems, conflicts.
.4 Problems which impede construction schedule.
.5 Review of off-site fabrication delivery schedules.
.6 Corrective measures and procedures to regain projected schedule.
.7 Revision to construction schedule.
.8 Progress schedule, during succeeding Work period.
.9 Review submittal schedules: expedite as required.
.10 Maintenance of quality standards.
.11 Review proposed changes for affect on construction schedule and on completion date.
.12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, Work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day Work week and define schedule calendar Working Days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project Work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 Working Days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Submit to Departmental Representative within 10 Working Days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Departmental Representative within 5 Working Days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Departmental Representative will review and return revised schedules within 5 Working Days.

.3 Revise impractical schedule and resubmit within 5 Working Days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.5 Utility locates.
.6 Soil excavation, handling, transporting and disposal.
.7 Backfill, compacting and grading.
.8 Building footings.
.9 Slab on grade.
.10 Structural Steel.
.11 Exterior metal cladding and Roofing.
.12 Interior Architecture (Walls, Floors and Ceiling.
.13 Water treatment equipment.
.14 New Mechanical Services on site (DCW, Sanitary).
.15 New Electrical Services on site.
.16 Plumbing.
.17 Lighting.
.18 Electrical.
.19 Piping.

.20 Controls.
.21 Heating, Ventilating, and Air Conditioning.
.22 Millwork.
.23 Fire Systems.
.24 Septic bed and tank installation.
.25 Testing and Commissioning.
.26 Site restoration.
.27 Demobilization.
.28 Supplied equipment long delivery items.
.29 Departmental Representative supplied equipment required dates.
.30 Overtime and premium pay to ensure milestone are met. Overtime and premium pay are to be included in Bid Price.

1.6 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.7 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings specified in Section 01 31 19, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Concurrently with monthly application for payment, provide dated photos of construction progress, completed building and features specific to Sustainability measures.

.2 Photo documentation required weekly and for each major installation and project milestone.

.3 All photos to be compiled and submitted at end of project.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 - EXECUTION

3.1 DOCUMENTATION

.1 Provide a representative collection of dated digital jpg photos of construction progress, including:

.1 Photos of site Work (excavation, landscaping etc).
.2 Photos of foundations.
.3 Photos of main building structure.
.4 Photos of envelope Work.
.5 Photos of interior fit-up.
.6 Photos of interior finishes.
.7 Photos of Erosion and Sedimentation control measures. Label each photo with date and specific ESC measure. Include photos of any corrective action taken. Photos should be taken at regular intervals from site clearing/demolition through to excavation and construction completion, and show all areas of the site covered in the plan.
.8 Photos of source-separated construction waste bins for waste diversion, if this method is being used to demonstrate waste diversion from landfill.
.9 Photos of good housekeeping measures, including: measures to keep absorbent materials protected, dry, and off the ground or floor (e.g. gypsum board, batt insulation); measures to maintain cleanliness of ductwork prior to and during installation (e.g. protection of open duct ends).

.2 Completed Building Photos:

.1 Provide dated digital jpg photos (max 1 Mb per photo) of completed building, including:

.1 Photos of each exterior building elevation.
.2 Photos of primary entrance to the building.
.3 Photos of all typical spaces.
.4 Photos of typical landscaping.
.5 Photos of signage communicating exterior smoking policy.
.6 Photos of signage communicating interior smoking policy.

.3 Additional Photos:

.1 Provide other photos as requested by Sustainability Departmental Representative to document sustainable design and construction.

END

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason
n for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

.10 Keep one reviewed copy of each submission on site.

.11 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward PDF, MS Word, MS Excel, and Autocad DWG files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.3 Indicate Materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 5 Working Days for Departmental Representative's review of each submission.

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, in duplicate, containing:
.1 Date.
.2 Project title and number.
.3 Contractor's name and address.
.4 Identification and quantity of each shop drawing, product data and sample.
.5 Other pertinent data.

8. Submissions shall include:
.1 Date and revision dates.
.2 Project title and number.
.3 Name and address of:
.1 Subcontractor.
.2 Supplier.
.3 Manufacturer.
.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
.5 Details of appropriate portions of Work as applicable:
.1 Fabrication.
.2 Layout, showing dimensions, including identified field dimensions, and clearances.
.3 Setting or erection details.
.4 Capacities.
.5 Performance characteristics.
.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Relationship to adjacent Work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit three hard copies and one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.11 Submit three hard copies and one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Report signed by authorized official of testing laboratory that Material, product or system identical to Material, product or system to be provided has been tested in accord with specified requirements.
.2 Testing must have been within 3 years of date of contract award for project.

.12 Submit three hard copies and one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or Material attesting that product, system or Material meets specification requirements.
.2 Certificates must be dated after award of project contract complete with project name.

.13 Submit three hard copies and one electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Pre-printed Material describing installation of product, system or Material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.

.14 Submit three hard copies and one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.16 Submit three hard copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.17 Delete information not applicable to project.

.18 Supplement standard information to provide details applicable to project.

.19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.20 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's business address.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and Material against which installed Work will be verified.

1.4 MOCK-UPS

.1 Erect mock-ups in accordance with Section 01 45 00.

1.5 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after Award of Contract, submit Workers' Safety and Insurance Board Experience Report.

.2 Submit transcription of insurance immediately after Award of Contract.

1.6 FEES, PERMITS AND CERTIFICATES

.1 Provide authorities having jurisdiction with information requested.

.2 Pay fees and obtain certificates and permits required.

.3 Furnish certificates and permits.

.4 Submit acceptable certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Safety Authority (ESA.)

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA):
.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 National Building Code 2015 (NBC):
.1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.

.3 National Fire Code 2015 (NFC):
.1 NFC 2015, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.

.4 Province of Ontario:
.1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
.2 O. Reg. 490/09, Designated Substances.
.3 Workplace Safety and Insurance Act, 1997.
.4 Municipal statutes and authorities.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
.1 Results of site specific safety hazard assessment.
.2 Results of safety and health risk or hazard analysis for site tasks and operations.
.3 Measures and controls to be implemented to address identified safety hazards and risks.

.3 Provide a Fire Safety Plan, specific to the Work location, in accordance with NBC, Division B, Article 8.1.1.1.3 prior to commencement of Work. The plan shall be coordinated with, and integrated into, the existing Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing Work.

.4 Contractor's and Subcontractors' Safety Communication Plan.

.5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Emergency Response requirements and procedures provided by Departmental Representative.

.6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

.7 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.8 Submit names of personnel and alternates responsible for site safety and health.

.9 Submit records of Contractor's Health and Safety meetings when requested.

.10 Submit 3 copies of Contractor's authorized representative's Work site health and safety inspection reports to Departmental Representative, weekly.

.11 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.

.12 Submit copies of incident and accident reports.

.13 Submit Safety Data Sheets (SDS).

.14 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to commencement of Work.

1.4 WORK PERMIT

.1 Obtain building permits related to project prior to commencement of Work.

1.5 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.7 REGULATORY REQUIREMENTS

.1 Comply with the Acts and regulations of the Province of Ontario.

.2 Comply with specified standards and regulations to ensure safe operations at site.

1.8 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:
.1 Silica in concrete, concrete block, ceramic tile.
.2 Mercury in flourescent light tubes.
.3 Asbestos in window caulking, plywood adhesive, bituminous tar.
.4 Lead in paint, solder on the joints of copper piping, cast iron drain pipe caulking, ceramic tile glazing, and emergency light batteries.
.5 Benzene in fuel storage tanks.
.6 Mould on concrete block walls.
.7 Halocarbons in refrigeration units.
.8 Overhead wires (240 volt).
.9 Contaminated soil and groundwater in project Work area. Refer to Section 02 81 01 and Designated Substances and Hazardous Building Materials Assessment in Appendix A for list of designated substances and hazardous materials and reports.
.10 Refer to Soil and Groundwater Assessment in Support of Proposed Construction Project, Port Weller Search and Rescue Station, Final Report, Dillon Consulting Limited, February 2019.

1.9 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.

.3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.11 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act and Regulations for Construction Projects for the Province of Ontario.

1.12 UNFORSEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.

.2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.13 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
.1 Have site-related working experience specific to activities associated with abatement of hazardous Materials.
.2 Have working knowledge of occupational safety and health regulations.
.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
.5 Be on site during execution of Work, and report directly to and be under direction of site supervisor.

1.14 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.
.1 Contractor's Safety Policy.
.2 Constructor's Name and had office information.
.3 Notice of Project.
.4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
.5 Ministry of Labour, Training, and Skills Development Orders and reports.
.6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
.7 Address and phone number of nearest Ministry of Labour, Training, and Skills Development office.
.8 Material Safety Data Sheets.
.9 Written Emeregency Response Plan.
.10 Site Specific Safety Plan.
.11 Valid certificate of first aider on duty, inspection card for first aid box, and Employer records of first aid treatment given.
.12 WSIB "In Case of Injury At Work" poster.
.13 Location of toilet and cleanup facilities.
.14 Company workplace violence and harassment policy.
.15 Ministry of Labour, Training, and Skills Development “Health & Safety at Work: Prevention Starts Here” poster.

.16 Registration of Constructors and Employers Engaged in Construction (Form 1000) for every employer on the jobsite.
.17 Location of nearest hospital (map).

1.15 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 BLASTING

.1 Blasting or other use of explosives is not permitted.

1.17 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.18 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

.2 Assign responsibility and obligation to Health and Safety Coordinator to stop or start Work when, at Health and Safety Coordinator's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END

PART 1 - GENERAL

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2015, and National Fire Code of Canada (NFC) 2015 including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply as directed by the Departmental Representative.

.2 Meet or exceed requirements of:
.1 Contract documents.
.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Stop Work immediately and notify Departmental Representative if Materials which may contain designated substances or PCB's, other than those identified in Section 01 35 29 are discovered in course of Work.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions.

1.4 RELICS AND ANTIQUITIES

.1 Relics and antiquities, and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tables, and similar objects found on site shall remain the property of Department of Fisheries and Oceans. Protect such articles and request directives from Departmental Representative.

.2 Should historic objects be uncovered during excavating, stop Work immediately and notify the Departmental Representative. Do not resume Work until directed to by the Departmental Representative.

.3 Departmental Representative will monitor the project Work and may require temporary stop of Work to carry out site investigations.

1.5 HISTORIC BUILDINGS

.1 The former Lighthouse Keepers Dwelling is a FHBRO recognized under the Treasure Board Heritage Buildings Policy.

.2 Protect this building from damage.

.3 The 1953 residence (now Search and Rescue Office DFRP 8642200) is also listed in the Directory of Federal Heritage Designations as a Recognized Federal Heritage Building, however approvals have been received for its removal.

1.6 IAQ - INDOOR AIR QUALITY

.1 Comply with CSA-Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651-18, articles 4.6.2 and 4.6.3.

1.7 ACCESSIBLE DESIGN

.1 Comply with CSA B651-18, Accessible Design for the Built Environment, unless specified otherwise. In any case of conflict or discrepancy between the building codes and CSA B651, the requirements of CSA B651 shall apply.

.2 SAR and IRB Stations may be exempt from some requirements of accessibility as outline in document, Custodial Rationale Identifying Exemptions to Real Property Accessibility Requirements for SAR and IRB Small Vessel Stations prepared by DFO dated January 10, 2020.

1.8 TAXES

.1 Pay applicable Federal, Provincial and Municipal taxes.

1.9 EXAMINATION

.1 Examine existing conditions and determine conditions affecting Work.

.2 Conduct concrete floor moisture testing using Calcium Chloride moisture tests.
.1 Submit test results to Departmental Representative for approval prior to installing any flooring. Conduct one test per 100 m^2 of area being covered.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 ABBREVIATIONS AND ACRONYMS

.1 The abbreviations and acronyms are commonly found in the Project Manual and represent the associated organizations or terms.

1.2 MATERIALS, EQUIPMENT AND METHODS

.1 A:
- .1 AB: anchor bolt.
- .1 ABUT: abutment.
- .2 AC: acoustic.
- .3 AC PAN: acoustic panel.
- .1 ACA: adhesive concrete anchors.
- .4 ACU: acoustic unit ceiling.
- .1 ADD'L: additional.
- .1 AEC: architecturally exposed concrete.
- .1 AESS: architecturally exposed structural steel.
- .5 AFF: above finished floor.
- .6 AFS: air flow measuring station.
- .7 AC PLAS: acoustic plaster.
- .8 ACT: acoustic tile.
- .9 ACR CU LVR: acrylic cube louvre.
- .10 ADH: adhesive.
- .11 ADJ: adjustable.
- .12 A/C: air conditioner.
- .13 AHU: air handling unit.
- .14 AL: aluminum.
- .15 ANOD: anodized.
- .16 APPROX: approximate.
- .17 ARCH: architecture.
- .18 ARCH BLK: architectural block.
- .19 AVB: air vapour barrier.

.2 B:
- .1 B: base.
- .2 BEAST: benthic assessment of sediment.
- .3 BH: bore hole.
- .4 BHP: brake horse power.
- .5 BL: bottom layer.
- .6 BLK: block.
- .7 BLKD: bulkhead.
- .8 BM: beam.
- .9 BOT: bottom.
- .10 BMP: best management practice.
- .11 B PL: base plate.
- .12 BRG: bearing.
- .13 BRK: brick.
- .14 BS: bleed sensor.
- .15 BSMT: basement.
- .16 BTEX: benzene, toluene, ethylbenzene and xylenes.

.17 BUR: built-up roof.

.3 C:
.1 C: ceiling mounted.
.2 CAL: caliper.
.3 CANTIL: cantilever.
.4 CB: catch basin.
.5 CC: centre to centre (architectural); cooling unit (mechanical).
.6 CCN: contemplated change notice.
.7 CD: condensate drain from heat pump
.8 CDF: controlled density fill.
.9 DCX: DX coil.
.10 CEC: Canadian Electrical Code.
.11 CF: chair fabric.
.12 CG: glycol coil.
.13 CH: Device mounted 150 mm above countertop.
.14 CHA: air cooled chiller.
.15 CHAN: channel.
.16 CHP: Childproof.
.17 CHS: Canadian hydrographic service.
.18 CJ: construction joint.
.19 CL: centreline.
.20 CK: cork.
.21 CLG: ceiling.
.22 CLR: clear.
.23 CO: carbon monoxide sensor.
.24 COL: column.
.25 CONC: concrete.
.26 CONC BLK: concrete block.
.27 CONC BRK: concrete brick.
.28 CONT: continuos.
.29 CONT J: control joint.
.30 COMPL: complete.
.31 CM: centimeter. (Nursery stock).
.32 CP: circulating pump.
.33 CPL: cement plaster.
.34 CPM: critical path method.
.35 CR: condensate receiver package.
.36 CT: ceramic tile.
.37 CTE: connect to existing.
.38 CU: condensing unit.
.39 CV: control valve.
.40 CVE: electric convector
.41 CVT: conductive vinyl tile.
.42 CVT: conductive vinyl tile.
.43 CW: curtain wall.
.44 C/W: complete with.

.4 D:
.1 D: door.
.2 dB: decibels.
.3 DB: dry-bulb.
.4 DCW: domestic cold water

.5 DD: dutch door.
.6 DEG: degree.
.7 DF: drinking fountain.
.8 DGP: demountable glass partition.
.9 DHW: domestic hot water
.10 DIA: diameter.
.11 DIM: dimension.
.12 DL: dead load.
.13 DMNT: demountable.
.14 DP: dampproofing.
.15 DR: door.
.16 DRP: drapery.
.17 DWL: dowel.
.18 DWM: dish washer.

.5 E:
.1 E: existing item to remain.
.2 EA: each.
.3 E/A: exhaust air.
.4 EC: empty conduit.
.5 ECF: engineered containment facility.
.6 ECR: epoxy coated reinforcement.
.7 EE: each end.
.8 EF: each face (architectural/structural).
.9 EF: exhaust fan (mechanical/electrical).
.10 EHW: Engineered Hardwood.
.11 EL: elevation.
.12 ELEC: electric.
.13 ELEV: elevator.
.14 EM: expanded metal.
.15 ENCL: enclosure.
.16 EPX: explosion proof (electrical).
.17 EQ: equal.
.18 ER: existing item to be relocated (electrical).
.19 ET: expansion tank.
.20 EXH: exhaust.
.21 EXIST: existing.
.22 EXPJ: expansion joint.
.23 EXP STRUCT: exposed structure (structural).
.24 EXT: exterior.
.25 EW: each way (architectural); eye wash (mechanical.
.26 EWT: entering water temperature.
.27 EX: existing.
.28 EX EXT: existing exterior wall.

.6 F:
.1 FC: fan coul unit.
.2 FD: floor drain or fire damper.
.3 FDN: foundation.
.4 FE/A: fume exhaust air.
.5 FEAT W: feature wall.
.6 FEXT: fire extinguisher.
.7 FFD: funnel floor drain

.8 FH: fire hose.
.9 FHC: fire hose cabinet.
.10 FHR: fire hose rack.
.11 FIN: finish.
.12 FIP: federal identity program.
.13 FL: floor.
.14 FLD: field.
.15 FLUOR: fluorescent.
.16 FR: frame.
.17 FRD: fire damper (rectangular).
.18 FRR: fire resistance rating.
.19 FSD: fire smoke damper.
.20 FTG: footing.

.7 G:
.1 G: grille and deffuser.
.2 GALV: galvanized steel.
.3 GB: grab bar.
.4 GC: General Conditions.
.5 GE/A: general exhaust air.
.6 GF: ground floor.
.7 GFI: ground fault interrupter.
.8 GL: glass or glazing.
.9 GL BLK: glass block.
.10 GLD: glass (demountable partition).
.11 GPC: gypsum plaster ceiling.
.12 GPW: gypsum plaster wall.
.13 GT: glass tile.
.14 GWB: gypsum board.
.15 GWBM: gypsum board mould resistant.

.8 H:
.1 HB: hose bib.
.2 HC: hollow core.
.3 H/C: handicap push button.
.4 HCWD: hollow core wood door.
.5 HD: hand dryer.
.6 HDW: hardware.
.7 HDWD: hardwood.
.8 HEX: heat exchanger.
.9 HM: hollow metal.
.10 HOR: horizontal.
.11 HOR EF: horizontal each face.
.12 HP: hydro pole (electrical); heat pump (mechanical).
.13 HPA: Hamilton Port Authority.
.14 HR: hour.
.15 HRU: heat recovery unit.
.16 HRV: heat recovery ventilator.
.17 HT: height.
.18 HTR: heater.
.19 HU: humidifier.
.20 HUE: instantaneous hot water.
.21 HUE: residential portable electric humidifier (mechanical).

.21 HWIE: hot water instantaneous heater.
.22 HWIG: instantaneous natural gas hot water.
.23 HWT: hot water tank.
.24 HWTE: electric hot water tank.
.25 HWTG: natural gas hot water tank heater.
.26 HYD: hydrant.
.27 HZ: Hertz frequency, cycles per second.

.9 I:
.1 ICF: insulated concrete formwork.
.2 ID: inside diameter.
.3 IG: isolated ground.
.4 INS: insulation.
.5 INTLK: interlock.
.6 IS: isolator.

.10 J:
.1 JT: joint.

.11 K:
.1 K: key operated.
.2 KE/A: kitchen exhaust air.
.3 KPL: kick plate.

.12 L:
.1 L: louvre.
.2 LAM: laminate.
.3 LAT: leaving air temperature.
.4 LAV: lavatory.
.5 LDG: landing.
.6 LG: laminated glass.
.7 LINO: linoleum.
.8 LL: live load.
.9 LPH: louvred penthouse.
.10 LT: light.
.11 LWT: leaving water temperature.

.13 M:
.1 MAS: masonry.
.2 MAS FL: masonry flashing.
.3 MAX: maximum.
.4 MBG: metal bar grating.
.5 MCL: metal cube louvre.
.6 MD: motorized damper.
.7 MECH: mechanical.
.8 MET DK: metal deck.
.9 MET FL: metal flashing.
.10 MET GRID CLG: metal grid ceiling.
.11 MET GRTG: metal grating.
.12 MET LIN CLG: metal linear ceiling.
.13 MET T PTN: metal toilet partition.
.14 MH: maintenance hole.
.15 MIN: minimum.

.16 MLP: metal lath and plaster.
.17 MO: masonry opening.
.18 MR: marble.
.19 MT: metal or metal threshold.
.20 MW: mounted millwork (electrical).
.21 MWP: membrane waterproofing.

.14 N:
.1 NBC: national building code.
.2 NC: normally closed.
.3 NF: no finish.
.4 NFC: national fire code.
.5 NIC: not in contract.
.6 NO: number.
.7 NO2: nitrogen oxide sensor.
.8 NRC: noise reduction coefficient.
.9 NRP: non removable pin.
.10 NTS: not to scale.

.15 O:
.1 OA O/A: outside air.
.2 OBC: Ontario building code.
.3 OC: on centre.
.4 OD: outside diameter.
.5 OPNG: opening.
.6 OPR: operator.
.7 OVHD: overhead.
.8 OWSJ: open web steel joist.

.16 P:
.1 P: prefinished (architectural) or pump (mechanical).
.2 PAH: polynuclear aromatic hydrocarbons.
.3 PARG: parging.
.4 PCC: precast concrete.
.5 PCT: porcelain ceramic tile.
.6 PED ACS FLG: pedestal access flooring.
.7 PF: panel fabric.
.8 PH: phase.
.9 PL: plate (architectural) or on/off switch complete with pilot light (electrical).
.10 PLAM: plastic laminate.
.11 PLAS: plaster.
.12 PLY: plywood.
.13 PLY SH: plywood sheathing.
.14 PR: pair.
.15 PRG: gas pressure regulator.
.16 PREFAB: prefabricated.
.17 PREFIN: prefinished.
.18 PRESS: pressure.
.19 PRFL: profile.
.20 PRV: pressure regulating valve.
.21 PT: paint.
.22 PTD: paper towel dispenser.

.23 PTN: partition.
.24 PVC: polyvinyl chloride.

.17 Q:
.1 QTB: quarry tile base.
.2 QTF: quarry tile floor.
.3 QTR: quarry tile roof.

.18 R:
.1 R: radius (architectural) or existing item to be removed (electrical) or refrigerant leak sensor (mechanica).
.2 RA or R/A: return air.
.3 RAD: return air damper.
.4 RB: resilient base (architectural) or relay base (electrical).
.5 RC: reinforced concrete.
.6 RCOND: refrigerant condenser line.
.7 RCPT: receptacle.
.8 RD: roof drain.
.9 RE: existing item in relocated position.
.10 REINF: reinforced/reinforcing.
.11 REQD: required.
.12 REQT: requirement.
.13 REVAP: refrigerant evaporator line
.14 RF: rubber flooring (architectural) or return fan (electrical).
.15 RHE: electric duct heater.
.16 RM: room.
.17 RO: rough opening (architectural); reverse osmosis (mechanical).
.19 RP: radiant panel.
.20 RRS: recycled rubber sheet.
.21 RRT: recycled rubber tile.
.22 RSD: rolling steel door.
.23 RSF: rubber sheet flooring.
.24 RT: rubber tile.
.25 RW: existing device with new wiring.
.26 RTU: roof top unit.
.27 RWL: rain water leader.

.19 S:
.1 S: sink
.2 SA or S/A: supply air.
.3 SAN: sanitary drainage line.
.4 SAN SEW: sanitary sewer.
.5 SAR: Search and Rescue.
.6 SCHED: schedule.
.7 SC: solid core (architectural) or separate circuit (electrical).
.8 SCRN: screen.
.9 SCWD: solid core wood door.
.10 SD: smoke developed or smoke damper.
.11 SDT: static dissipative tile.
.12 SE/A: sanitary exhaust air.
.13 SECT: section.
.14 SF: supply fan.
.15 SFT water softener.

.16 SH: sill height (architectural); shower (mechanical).
.17 SIM: similar.
.18 SL: sliding or silencer.
.19 SLR: sealer.
.20 SPEC: specification.
.21 SS: stainless steel.
.22 ST: stained (architectural); storage tank (mechanical).
.23 STD: standard.
.24 STL: steel.
.25 STL BM: steel beam.
.26 STC: sound transmission class.
.27 STL FL DK: steel floor deck.
.28 STL PL: steel plate.
.29 STN: stone.
.30 STR: structure or structural.
.31 ST SEW: storm sewer.
.32 S&U: stain and urethane.
.33 S&V: stain and varnish.
.34 SVT: solid vinyl tile.

.20 T:
.1 T: top or temperature sensor/thermostat.
.2 TA: transfer air opening.
.3 T&B: top and bottom.
.4 TCB: turbidity control plan.
.5 TD: trench drain.
.6 TEL: telephone.
.7 TER: terrazzo.
.8 TERT: terrazzo tile.
.9 THKNS: thickness.
.10 THR: threshold.
.11 TL: twist lock.
.12 TMPD: tempered.
.13 TOPG: topping.
.14 TP: tamper proof.
.15 TRD: toilet roll dispenser.
.16 TRANSV: transverse.
.17 TSP: electronic trap seal primer.
.18 TYP: typical.

.21 U:
.1 U: urethane.
.2 U/C: undercut.
.3 UGRD: underground.
.4 UHE: unit heater
.5 UNO: unless noted otherwise.
.6 UOS: unless otherwise specified.
.7 U/S: underside.
.8 UR: urinal.

.22 V:
.1 V: volt (electrical); sanitary vent (mechanical).
.2 VCF: vinyl coated fabric.

.3 VCT: vinyl composition tile.
.4 VCT SD: vinyl composition tile (static dissipative).
.5 VD: volume damper.
.6 VEL: velocity.
.7 VERT: vertical.
.8 VERT B: vertical blinds.
.9 VERT EF: vertical each face.
.10 VSF: vinyl sheet flooring.
.11 VPT: vinyl plank flooring.
.12 VT: vinyl tile.
.13 VWC: vinyl wall covering.

.23 W:
.1 W: window.
.2 WB: wood base.
.3 WB: wash box (mechanical)
.4 WC: water closet.
.5 W-C: wall connectors.
.6 WD: wood.
.7 WV: wood veneer.
.8 WG: water gauge (mechanical) or wire guard (electrical).
.9 WH: wall hydrant.
.10 WHMIS: workplace hazardous materials information system.
.11 WP: waterproofing (architectural) or waterproof (electrical).
.12 WR: washroom.
.13 WSIB: workplace safety and insurance board.
.14 WT: weight (structural) or water tight (electrical).
.15 WTP: water treatment plant.

1.3 STANDARDS ORGANIZATIONS

.1 Standards writing organizations:
.1 AA - Aluminum Association.
.2 ACPA - American Concrete Pipe Association.
.3 ANSI - American National Standards Institute.
.4 ASHRAE - American Society of Heating and Refrigerating and Air-Conditioning Engineers.
.5 ASTM - American Society for Testing and Materials.
.6 AWMAC/WI - Architectural Woodwork Manufacturers Association of Canada/Woodwork Institute.
.7 AWPA - American Wood Preservers' Association.
.8 AWWA - American Water Works Association.
.9 BHMA - Builders Hardware Manufacturers Association.
.10 CCDC - Canadian Construction Documents Committee.
.11 CCMPA - Canadian Concrete Masonry Producers Association.
.12 CGSB - Canadian General Standards Board.
.13 CNTA - Canadian Nursery Trades Association.
.14 CPCA - Canadian Painting Contractors Association.
.15 CRCA - Canadian Roofing Contractors Association.
.16 CSA - Canadian Standards Association.
.17 CSC - Construction Specifications Canada.
.18 CSDMA - Canadian Steel Door Manufacturers Association.
.19 CSI - Construction Specifications Institute.

.20 CSSBI - Canadian Sheet Steel Building Institute.
.21 CRCA - Canadian Roofing Contractors Association.
.22 DHI - Door and Hardware Institute.
.23 EEMAC - Electrical and Electronic Manufacturer's Association of Canada.
.24 ESA - Electrical Safety Authority.
.25 FCC - Fire Commissioner of Canada.
.26 FSC - Forest Stewardship Council.
.27 GANA - Glass Association of North America.
.28 HMMA - Hollow Metal Manufacturers Association.
.29 IEEE - Institute of Electrical and Electronics Engineers Inc.
.30 ISO - International Organization for Standardization.
.31 IWFA - International Window Film Association.
.32 LEED - LEED Canada, Leadership in Energy and Environmental Design.
.33 MPI - Master Painters Institute.
.34 NAAMM - National Association of Architectural Metal Manufacturers.
.35 NCPI - National Clay Pipe Institute.
.36 NEMA - National Electrical Manufacturers Association.
.37 NFPA - National Fire Protection Association.
.38 OPSD - Ontario Provincial Standard Drawings.
.39 OPSS - Ontario Provincial Standard Specifications.
.40 PPI - Plastics Pipe Institute.
.41 SDI - Steel Door Institute.
.42 SCAQMD - South Coast Air Quality Management District.
.43 TIA - Telecommunications Industry Association.
.44 TIAC - Thermal Insulation Association of Canada.
.45 TTMAC - Terrazzo Tile and Marble Association of Canada.
.46 UL - Underwriters Laboratories.
.47 ULC - Underwriters Laboratories of Canada.
.48 US EPA - United States Environmental Protection Agency.
.49 WH - Warnock Hersey.

1.4 FEDERAL GOVERNMENT DEPARTMENTS AND AGENCIES

.1 Departments, agencies and crown corporations.
.1 CCME – Canadian Council of Ministers of the Environment.
.2 CEAA - Canadian Environmental Assessment Agency.
.3 CSC - Correctional Service Canada.
.4 CRA - Canada Revenue Agency.
.5 DND - Department of National Defence.
.6 ECCC - Environment and Climate Change Canada.
.7 FHBRO - Federal Heritage Buildings Review Office.
.8 HC - Health Canada.
.9 HCD - Heritage Conservation Directorate.
.10 LC - Labour Canada.
.11 PC - Parks Canada.
.12 PSPC - Public Service Procurement Canada.
.13 PWGSC - Public Works and Government Services Canada.
.14 RCMP - Royal Canadian Mounted Police.
.15 TBS - Treasury Board Secretariat.
.16 TC - Transport Canada.

1.5 PROVINCIAL GOVERNMENT DEPARTMENTS AND AGENCIES

.1 MECP - Ontario Ministry of Environment, Conservation, and Parks.

.2 MOLTSD - Ontario Ministry of Labour, Training, and Skills Development.

.3 MTO and MOT - Ontario Ministry of Transportation.

.4 TSSA - Technical Standards and Safety Authority.

1.6 INTERNATIONAL GOVERNMENT DEPARTMENTS AND AGENCIES

.1 DOHMH - New York City Department of Health and Mental Hygiene, USA.

.2 GSA - Government Services Administration, USA.

1.7 UNITS OF MEASURE METRIC

.1 The following abbreviations of units of measure are commonly found in the Project Manual:
.1 C: Celsius.
.2 cm: centimetre.
.3 kg: kilogram.
.4 kg/m³: kilogram per cubic metre.
.5 kN: kilonewton.
.6 kPa: kilopascals.
.7 kw: kilowatts.
.8 l/s: litre per second.
.9 m: metre.
.10 m³: cubic metre.
.11 mg/kg: milligrams per kilogram.
.12 mg/L: milligrams per litre.
.13 mm: millimetres.
.14 MPa: megapascal.
.15 NTU: nephelometric turbidity unit.
.16 ppm: parts per million.
.17 ug/L: micrograms per litre.
.18 ug/m³: micrograms per cubic metre.

1.8 UNITS OF MEASURE IMPERIAL

.1 The following abbreviations of units of measure are commonly found in the Project Manual:
.1 BTU: British thermal units.
.2 CFM: cubic feet per minute.
.3 F: Fahrenheit.
.4 ft: foot/feet.
.5 FPI: fins per inch.
.6 FPM: feet per minute.
.7 ga: gauge.
.8 gpm: gallons per minute.
.9 in: inches.
.10 lbs: pounds.

.11 NTU: nephelometric turbidity unit.
.12 psi: pounds-force per square inch.
.13 PSIG: PSI gauge.
.14 ppm: parts per million.
.15 RPM: revolutions per minute.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-ups.

.4 Mill tests.

.5 Equipment and system adjust and balance.

1.3 INSPECTION

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work, above and beyond those required of the Contractor. Cost of such services will be borne by Departmental Representative.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.5 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

.1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Amount difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

1.8 REPORTS

.1 Submit 4 copies of inspection and test reports to Departmental Representative.

.2 Provide copies to Subcontractor of Work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.9 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative and may be authorized as recoverable.

1.10 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations acceptable to Departmental Representative unless otherwise specified.

.3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.

.6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.11 MILL TESTS

.1 Submit mill test certificates as requested.

1.12 EQUIPMENT AND SYSTEMS

.1 Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Environmental Protection Act and associated Regulations.

.2 U.S. Environmental Protection Agency (EPA) / Office of Water
.1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute Work expeditiously.

.2 Remove from site all such Work after use.

1.4 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

.2 Comply with Sections 01 35 13.43 and 01 35 43.

1.5 WATER SUPPLY

.1 Contractor is responsible for arranging their own potable water supply. Arrange for delivery, storage, and distribution, maintenance, and removal.

1.6 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:
.1 Facilitate progress of Work.
.2 Protect Work and products against dampness and cold.
.3 Prevent moisture condensation on surfaces.
.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10°C in areas where construction is in progress.

.5 Ventilating:
.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
.4 Ventilate storage spaces containing hazardous or volatile materials.
.5 Ventilate temporary sanitary facilities.
.6 Continue operation of ventilation and exhaust system for time after cessation of Work process to assure removal of harmful contaminants.

.6 Permanent heating system of building shall not be used for temporary heating and ventilation.

.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.
.5 Vent direct-fired combustion units to outside.

.8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 TEMPORARY POWER

.1 Contractor to provide temporary power. Power shall be maintained to assets on site, including gauge station, office for Departmental Representative, and dock.

.2 Temporary power for equipment is responsibility of Contractor.

.3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

.4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.8 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, data hook up, lines and equipment necessary for own use and use of Departmental Representative.

1.9 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, waterways and walkways in accordance with Section 01 35 43.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
- .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)
- .1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CSA 0121-17, Douglas Fir Plywood.
- .3 CSA Z797-18, Code of Practice for Access Scaffold.
- .4 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CSA, CCOHS and Techstreet.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.4 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute Work expeditiously.

.5 Remove from site all such Work after use.

1.5 SCAFFOLDING

.1 Scaffolding in accordance with CSA Z797.

.2 Provide and maintain scaffolding, ramps, ladders, platforms, and temporary stairs required for the Work.

1.6 HOISTING

.1 Provide, operate and maintain hoists/cranes required for moving of workers, Materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists/cranes shall be operated by qualified operator.

1.7 SITE STORAGE/LOADING

.1 Confine Work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work and access to road, dock, and ramp.

.2 Provide and maintain adequate access to project site.

.3 Build and maintain temporary roads where indicated or directed by Departmental Representative and provide snow removal during period of Work.

.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.9 SECURITY

.1 Ensure that construction areas and contents are secure for the full length of private road after secure access gated, indicated on drawing 2/A000, after working hours and during holidays.

1.10 OFFICES

.1 Provide office heated to 22°C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

.4 Departmental Representative's Site office.
.1 Provide temporary office for Departmental Representative.

.2 Inside dimensions minimum 3.6 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 4 50% opening windows and one lockable door.
.3 Insulate building and provide heating system to maintain 22° C inside temperature at -20° C outside temperature.
.4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
.5 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10% upward light component.
.6 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
.7 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.
.8 Maintain in clean condition.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and Materials.

.2 Locate Materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with Work activities.

1.12 SANITARY FACILITIES

.1 Provide sanitary facilities for Work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.13 CONSTRUCTION SIGNAGE

.1 No other signs or advertisements, other than warning signs, are permitted on site.

.2 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321.

.3 Maintain approved signs and notices in good condition for duration of project, and dispose of off Site on completion of project or earlier if directed by Departmental Representative.

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and Work, and erection and maintenance of adequate warning, danger, and direction signs.

.4 Protect travelling public from damage to Person and property.

.5 Contractor's traffic on roads selected for hauling Material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.10 Dust control: adequate to ensure safe operation at all times.

.11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.

.12 Lighting: to assure full and clear visibility for full width of haul road and Work areas during night Work operations.

.13 Provide snow removal during period of Work for entire Site. Ensure road access to boat dock are free of debris and snow and are available for Coast Guard personnel use at all times.

.14 Coordinate road repairs to road to boat dock in accordance with Departmental Representative. Ensure road to docks are operational at all times.

.15 Remove, upon completion of Work, haul roads designated by Departmental Representative.

1.15 CLEAN-UP

.1 Remove construction debris, waste Materials, packaging Material from Work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store Materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged Material.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such Work after use.

1.3 FENCING

.1 Existing site fencing can be used to secure Site. Maintain existing fencing in good condition. Coordinate security options with Departmental Representative.

.2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.4 TEMPORARY FENCING

.1 Access by staff required to areas indicated on Construction Staging Plan such as Hoop House, gas/diesel tanks, boat dock and ramp.

.2 Gate in temporary fencing to be provided where required for staff to access areas on site such as the gauge station.

1.5 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, and open edges of floors and roofs.

.2 Provide as required by governing authorities.

1.6 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior Work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.7 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such Work is complete.

1.8 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.9 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.10 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.12 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Existing facilities.

1.2 REFERENCES

.1 Within text of specifications, reference may be made to reference standards.

.2 Conform to these standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.4 The cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

.6 OPSS Ontario Provincial Standard Specifications and OPSD Ontario Provincial Standard Drawings quoted in these specifications are available online at http://www.library.mto.gov.on.ca/SydneyPLUS/TechPubs/Portal/tp/opsSplash/aspx.

1.3 QUALITY

.1 Products, Materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Amount or Contract Time.

1.5 METRIC SIZED MATERIALS

.1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.

.2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.

.3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.

.4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.

.5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar Materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet Materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up Materials to match original. Do not paint over name plates.

1.7 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative. Unload, handle and store such products.

1.8 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Amount or Contract Time.

1.9 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.10 CO-ORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.11 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.12 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial Work by specialists familiar with Materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.14 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent Materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and Materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior Work, unless stainless steel or other Material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic Material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of Material to which anchorage is made are not acceptable.

1.15 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with Material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No.304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.17 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Field engineering survey services to measure and stake site.

.2 Survey services to establish and confirm inverts for Work.

1.2 REFERENCES

.1 Owner's identification of existing survey control points and property limits.

1.3 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Departmental Representative.

1.4 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site Work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Departmental Representative.

.4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.5 SURVEY REQUIREMENTS

.1 Establish one permanent bench mark on site, referenced to established bench marks by survey control points. Record location, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement.

.4 Establish pipe invert elevations.

.5 Stake batter boards for foundations.

.6 Establish foundation and floor elevations.

.7 Establish lines and levels for mechanical and electrical Work.

1.6 EXISTING SERVICES

.1 Before commencing Work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.7 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.8 RECORDS

.1 Maintain a complete, accurate log of control and survey Work as it progresses.

.2 Record locations of maintained, re-routed and abandoned service lines.

1.9 SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering Work.

.3 Submit certificate signed by surveyor certifying those elevations and locations of completed Work that conform and do not conform with Contract Documents.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Submit written request in advance of cutting or alteration which affects:
- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate Contractor.

.3 Include in request:
- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate Contractor.
- .7 Written permission of affected separate Contractor.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Remove samples of installed Work for testing, if required.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.9 Cut rigid Materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry Work without prior approval.

.10 Restore Work with new products in accordance with requirements of Contract Documents.

.11 Submit proposed Materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.

.12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.13 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.14 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping Material in accordance with Section 07 84 00, full thickness of the construction element.

.15 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse, recycling, composting and anaerobic digestion in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final cleaning.

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

.2 Remove waste Materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste Materials on site.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste Materials and debris.

.6 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20.

.7 Remove waste Material and debris from site and deposit in waste container at end of each working day.

.8 Dispose of non-contaminated waste Materials and debris off site. Dispose of contaminated waste Material in accordance with Section 01 74 20.

.9 Clean interior areas prior to start of finish Work, and maintain areas free of dust and other contaminants during finishing operations.

.10 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.11 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.12 Use only cleaning Materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning Material manufacturer.

.13 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 FINAL CLEANING

.1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris other than that caused by Owner or other Contractors.

.5 Remove waste Materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste Materials on site.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.8 Remove stains, spots, marks and dirt from decorative Work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.18 Clean roofs, downspouts, and drainage systems.

.19 Remove debris and surplus Materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to building.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
.2 Request Departmental Representative's Inspection.

.2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:
.1 Work has been completed and inspected for compliance with Contract Documents.
.2 Defects have been corrected and deficiencies have been completed.
.3 Equipment and systems have been tested, adjusted, and balanced and are fully operational.
.4 Certificates required by PWGSC Fire Protection Engineer and Authorities having jurisdiction have been submitted.
.5 Operation of systems have been demonstrated to Departmental Representative.
.6 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.2 CLEANING

.1 In accordance with Section 01 74 00.

.2 Remove waste and surplus Materials, rubbish and construction facilities from the site in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

.8 Mitigation Measures Checklist, Appendix B

1.2 SUBMISSION

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Copy will be returned after final inspection, with Departmental Representative's comments.

.3 Revise content of documents as required prior to final submittal.

.4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies and one electronic copy on USB of maintenance manuals and commissioning documentation in English.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.6 If requested, furnish evidence as to type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.8 Pay costs of transportation.

1.3 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dwg format. Forward pdf, MS Word, MS Excel, and Autocad dwg files on USB compatible with PSPC/PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.4 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;
.1 Date of submission; names,
.2 Addresses, and telephone numbers of Contractor with name of responsible parties;
.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:
.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

.6 Training: Refer to Section 01 79 00.

1.5 AS-BUILTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:
.1 Contract Drawings.
.2 Specifications.

.3 Amendments and addenda.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

.6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

.7 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
.1 Measured depths of elements of foundation in relation to finish first floor datum.
.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.4 Field changes of dimension and detail.
.5 Changes made by change orders.
.6 Details not on original Contract Drawings.
.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:
.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
.2 Changes made by Amendments and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01 71 00, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01 45 00.

.15 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.10 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.11 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.12 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.14 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

1.15 MITIGATION MEASURES AND REPORT FORM

.1 Submit completed Mitigation Measures and Report Form, Appendix B, to Departmental Representative once all project activities have been completed.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Procedures for demonstration and instruction of equipment and systems to Owner's O&M personnel.

.2 O&M personnel includes Departmental Representative, building operators, maintenance staff, security staff and technical specialists, as applicable.

1.2 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.3 QUALITY CONTROL

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

.2 Submit training schedule of time and date for demonstration and training of each item of equipment and each system in accordance with the training plan four weeks prior to designated dates, for Departmental Representative's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Report shall give time and date of each demonstration and training, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation.

.2 Testing, adjusting, and balancing has been performed in accordance with Section 01 77 00 and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated O&M personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.

.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.3 Review contents of manual in detail to explain all aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

.1 Allocate one week for demonstration and instruction for all, and not limited to, equipment, appliances, devices, and all items requiring operations and maintenance.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Includes general requirements for commissioning facilities and facility systems.

1.2 RELATED SECTIONS

.1 Section 26 12 16.

.2 Section 26 13 17.

.3 Section 26 24 02.

.4 Section 26 32 13.01.

.5 Section 26 32 13.03.

.6 Section 26 33 53.

.7 Section 26 36 23.

.8 Section 28 31 00.

1.3 QUALITY ASSURANCE

.1 Co-operate with System Commissioning Administrator under provisions specified in this Section.

.2 Comply with applicable procedures and standards of the certification sponsoring association.

.3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.4 REFERENCES

.1 NETA Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems 2009.

1.5 SUBMITTALS

.1 Submit documentation to confirm System Commissioning Administrator compliance with quality assurance provision.

.2 Submit completed report forms within 3 days after completion of each testing to Consultant for review and verification.

.3 Fifteen days prior to Substantial Performance, submit 3 copies of final reports on applicable forms for functional performance verification.

.4 Submit post-commissioning reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

.5 Submit all other commissioning documentation in accordance with Section 01 91 01.

1.6 REPORT FORMS

.1 System Commissioning Administrator shall make reports.

.2 Report forms shall include:
- .1 Startup Checklists.
- .2 Product Information (PI) Report forms.
- .3 Performance Verification (PV) Report forms.

.3 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.

.4 Submit signed form to Consultant for review and approval. After approval, immediately submit form bearing Consultant's signature to Departmental Representative.

.5 Submit signed form to Departmental Representative for review, approval and signature.

.6 Identify each instrument used for testing, adjusting and balancing and its latest date of calibration.

1.7 CONTRACTOR'S RESPONSIBILITIES

.1 Prepare each system for testing.

.2 Cooperate with testing organization and provide access to equipment and systems.

.3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

.4 Notify testing organization and Departmental Representative 7 days prior to time project will be ready for testing, adjusting, and balancing.

.5 Accurately record data for each step.

.6 Report to Departmental Representative any deficiencies or defects noted during performance of services.

.7 Correct deficiencies identified in accordance with Departmental Representative's written instructions.

1.8 PREPARATION

.1 Make instruments available to Departmental Representative to facilitate spot checks during testing and functional performance verification.

.2 Verify systems installation is complete and in continuous operation.

.3 Verify lighting is turned on when lighting is included in cooling load.

1.9 EXECUTION

.1 Test equipment, Electrical Power Distribution Equipment and Systems.

1.10 SCHEDULE OF SYSTEMS REQUIRING TESTING SERVICES

General Requirements.

.1 Section 26 13 17.

.2 Section 26 32 13.01.

.3 Section 26 33 53.

.4 Section 26 36 23.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Removal of asphalt paving.

.3 Concrete slabs.

.4 Concrete barricades.

.5 Selected site structures.

.6 Hydro pole and overhead wiring.

.7 Garden Enclosure.

.8 Wood posts complete with hose bibs.

.9 Diesel Generator

.10 Oil tank.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Site Meetings.
.1 Convene pre-demolition meeting one week prior to beginning work of this Section in accordance with Section 01 31 19 to:
.1 Verify project requirements.
.2 Review site conditions.
.3 Co-ordination with other subtrades.

.2 Scheduling: meet project time lines without compromising specified minimum rates of material diversion.
.1 Notify Departmental Representative in writing when unforeseen delays occur.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.3 Hazardous Materials:
.1 Provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.

.4 Waste Reduction Workplan:
.1 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 20 and indicate:
.1 Descriptions of and anticipated quantities in percentages of materials to be recycled and landfilled.
.2 Schedule of selective demolition.
.3 Number and location of dumpsters.
.4 Anticipated frequency of tippage.

.5 Name and address of haulers, waste facilities, and waste receiving organizations.

.5 Certificates:
.1 Submit copies of certified weigh bills and receipts from authorized disposal sites and reuse and recycling facilities for material removed from site upon request of Departmental Representative.
.2 Written authorization from Departmental Representative is required to deviate from haulers, facilities, and receiving organizations listed in Waste Reduction Workplan.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with Section 01 35 43.

.2 Storage and Protection.
.1 Protect existing items designated to remain. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Departmental Representative.
.2 Store and protect in accordance with requirements for maximum preservation of material.

.3 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.5 SITE CONDITIONS

.1 Site Environmental Requirements.
.1 Perform work in accordance with Section 01 35 43.
.2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
.3 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
.1 Ensure proper disposal procedures are maintained throughout the project.
.4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities and as directed by Departmental Representative.
.6 Protect trees, plants and foliage on site and adjacent properties where indicated.

.2 Existing Conditions.
.1 Remove contaminated or hazardous materials as defined by authorities having jurisdiction from site, prior to start of demolition Work, and dispose of at designated disposal facilities in safe manner.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Use cold milling, planning, cutting, or grinding equipment with automatic grade controls capable of operating from stringline, and capable of removing part of pavement surface to depths or grades indicated.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed. Sawcut extent of asphalt to be removed. Sawcut and prepare lap joints as detailed on the Contract Drawings at all existing-new pavement interface unless otherwise noted.

.2 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, and items to remain.

.3 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.4 Notify and obtain approval of utility companies before starting demolition.

3.2 PROTECTION

.1 Protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Departmental Representative at no additional cost.

3.3 REMOVAL OF HAZARDOUS WASTES

.1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

3.4 REMOVAL OPERATIONS

.1 Remove items as indicated.

.2 Do not disturb items designated to remain in place.

.3 Removal of pavements, curbs and gutters:
.1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
.2 Protect adjacent joints and load transfer devices.
.3 Protect underlying and adjacent granular materials.

.4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving,

.5 Disposal of Material:
.1 Dispose of materials not designated for reuse on site as instructed by Departmental Representative at authorized facilities approved in Waste Reduction Workplan.

.6 Backfill:
.1 Backfill in areas as indicated and in accordance with Section 31 23 33.01.

3.5 MILLING

.1 Remove existing asphalt pavement to lines and grades as indicated.

.2 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.

.3 Provide for suppression of dust generated by removal process.

.4 Remove asphalt to be taken to recycling facility.

.5 Sweep up joints and milled surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.

3.6 STOCKPILING

.1 Label stockpiles, indicating material type and quantity.

.2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.

.3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.

.4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.7 REMOVAL FROM SITE

.1 Remove stockpiled material as directed by Departmental Representative when it interferes with operations of project.

.2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.

.3 Transport material designated for alternate disposal using approved haulers, facilities, receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations.

.4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
.1 Disposal Facilities: approved and listed in Waste Reduction Workplan.
.2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

3.8 RESTORATION

.1 Restore areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.
.2 Remove debris, trim surfaces and leave work site clean, upon completion of Work
.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

.1 Repair damage to adjacent materials or property caused by selective site demolition.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).
.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 Department of Justice Canada (Jus).
.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
.2 Canadian Environmental Protection Act, 1999 (CEPA), c. 33.

.3 Transport Canada (TC).
.1 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

1.2 DEFINITIONS

.1 Alternate Disposal: reuse and recycling of Materials by designated facility, user or receiving organization which has valid Certificate of Approval to operate. Alternative to landfill disposal.

.2 Deconstruction: systematic dismantling of structure in a manner that achieves safe removal/disposal of hazardous Materials and maximum salvage/recycling of Materials.
.1 Ultimate objective is to recover potentially valuable resources while diverting from landfill what has traditionally been significant portion of waste system.

.3 Demolition: rapid destruction of structure with or without prior removal of hazardous Materials.

.4 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, including but not limited to: corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other Material that can endanger human health, well being or environment if handled improperly.

.5 Recycle: process by which waste and recyclable Materials are transformed or collected for purpose of being transferred into new products.

.6 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded Materials for purpose of using in altered form.
.1 Recycling does not include burning, incinerating, or thermally destroying waste.

.7 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
.1 Salvaging reusable Materials from remodelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
.2 Returning reusable items including pallets or unused products to vendors.

.8 Salvage: removal of structural and non-structural Materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.9 Source Separation: acts of keeping different types of waste Materials separate, beginning from first time they became waste.

.10 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

1.3 PERFORMANCE REQUIREMENTS

.1 Separate Materials from waste stream to obtain minimum 75% waste diversion target.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Submit pre-demolition audit and deconstruction/disassembly plan prior to starting Work.

.3 Submit copies of bills of lading from authorized disposal sites and reuse and recycling facilities for Material removed from site to Departmental Representative weekly upon request.
.1 Written authorization from Departmental Representative is required to deviate from facilities listed in Waste Reduction Workplan.

.4 Include following information:
.1 Time and date of removal.
.2 Description of Materials.
.3 Quantityof Material.
.4 Breakdown of reuse, recycling and landfill percentages.
.5 End destination of Materials.

.5 Workers, haulers and Subcontractors must possess current, applicable permits to remove, handle and dispose of wastes categorized Provincially as hazardous.
.1 Provide proof of compliance within 24 hours upon written request of Departmental Representative.

1.5 QUALITY ASSURANCE

.1 Ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable provincial regulations.

.2 Mock-up:

.1 Provide mock-up of exterior coating removal Work in accordance with Section 01 45 00 in location indicated.

.2 Mock-up will be used: To judge degree of removal, quality, workmanship, removal technique, and finish.

.3 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with repair Work.

.4 When accepted, mock-up will demonstrate minimum standard of removal Work, quality, workmanship, and finish required for this Work. Approved mock-up may remain as part of finished Work.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Store and manage hazardous Materials in accordance with Sections 01 35 43 and 01 61 00.

.2 Storage and Protection.

.1 Protect in accordance with Section 01 61 00.

.2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Owner.

.3 Remove and store Materials to be salvaged, in manner to prevent damage.

.4 Store and protect in accordance with requirements for maximum preservation of Material.

.5 Handle salvaged Materials as new materials.

.3 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Do Work in accordance with Section 01 35 43.

1.8 SITE CONDITIONS

.1 Existing Conditions.

.1 Should Materials resembling designated substances be encountered in course of deconstruction, stop Work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received.

.2 Label and package component parts of mechanical and electrical Material specified for salvage in accordance with Departmental Representative's instructions to prevent damage or loss.

.2 Protection.

.1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades and parts of existing structure to remain. Provide bracing, shoring and underpinning as required. Repair damage caused by deconstruction as directed by Departmental Representative.

.2 Support affected structures and, if safety of structure being deconstructed or adjacent structures or services appear to be endangered, take preventative measures. Cease operations and immediately notify Departmental Representative.

.3 Prevent debris from blocking surface drainage system, mechanical and electrical systems.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Where possible, use water efficient wetting equipment/trucks/attachments when minimizing dust.

.3 Demonstrate that tools are being used in manner which allows for salvage of Materials in best condition possible.

2.2 MATERIALS

.1 All Materials requiring removal shall become the Contractor's property and shall be removed and disposed of from the site, as the Work progresses, unless indicated otherwise.

.2 Salvaged Material: Salvage and stockpile original Materials as indicated on site or drawings. Salvaged Materials shall not be chipped, cracked, split, stained or damaged. Store items off of moist surfaces.

PART 3 - EXECUTION

3.1 SITE VERIFICATION OF CONDITIONS

.1 Refer to all investigations, reports, and surveys appended to these Documents and listed in Appendix A of the List of Contents.

3.2 PREPARATION

.1 Disconnect and re-route electrical, telephone and communication service lines entering buildings to be deconstructed. Post warning signs on electrical lines and equipment which must remain energized to serve other products during period of demolition.

.2 Locate and protect utility lines. Do not disrupt active or energized utilities designated to remain undisturbed.

.3 Disconnect and cap designated mechanical services.
.1 Natural gas supply lines: remove in accordance with utility company requirements.
.2 Sewer and water lines: remove in accordance with requirements of authority having jurisdiction.
.3 Other underground services: remove and dispose of as indicated and as directed by Departmental Representative.

.4 Contain debris and waste Material generated during the demolition and removals Work. Dispose of collected debris and waste Materials in accordance with Authorities having jurisdiction.

3.3 DEMOLITION, GENERAL

.1 Perform demolition with extreme care. Confine effects of demolition to those parts which are to be demolished.

.2 Perform Work and prevent inconvenience to persons outside those parts which are to be demolished.

.3 Carry out demolition in accordance with the requirements of CSA S350.

3.4 REMOVAL OF HAZARDOUS WASTES

.1 Prior to start of deconstruction Work remove contaminated or hazardous Materials as defined by authorities having jurisdiction from site and dispose of at designated disposal facilities in safe manner in accordance with TDGA and other applicable regulatory requirements.

3.5 DISASSEMBLY AND REMOVALS

.1 Unless otherwise indicated, Materials removed from designated structures are property of Contractor.

.2 Throughout course of deconstruction pay close attention to connections and Material assemblies. Employ workmanship procedures which minimize damage to Materials and equipment.

.3 Ensure workers and Subcontractors are trained to carry out Work in accordance with appropriate deconstruction techniques.

.4 Project supervisor with previous deconstruction experience must be present on site throughout project.

.5 Deconstruct in accordance with CSA S350 and other applicable safety standards.

.6 Workers must utilize adequate fall protection where necessary.

.7 Maintain structural integrity of structure.

.8 Systematically remove finishes, furnishings, and mechanical and electrical equipment as indicated.

.9 Carefully remove windows from structure in the historic building.
.1 Remove existing window systems as indicated.
.2 Remove existing windows where indicated to be replaced only as new windows are ready for installation. Openings shall not be open to weather for more than a few hours from removal of existing windows to installation of new windows.
.3 Thoroughly clean openings of dust, dirt, mortar and other foreign Materials prior to installation of new windows. Ensure openings are dry prior to installation of new windows.
.4 Dispose of removed Materials in accordance with authorities having jurisdiction.

.10 Removal of existing exterior coatings on concrete:
.1 Clean and prepare surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements and as follows.
.2 Remove existing exterior coating as indicated
.3 Equipment and processes for removals Work to be non-abrasive and capable of removing existing coatings while enabling containment of removed Material.
.4 Ensure all precautions are taken to avoid damage to existing board formed concrete surface beneath coating.
.5 Remove and dispose of Material and debris resulting from removal of existing exterior coatings.

.11 Removal of delaminated and deteriorated concrete elements:
.1 Remove delaminated and deteriorated concrete elements as indicated.
.2 Equipment and processes for removal of delaminated and deteriorated concrete elements to be capable of removing delaminated and deteriorated elements without damaging sound concrete to remain.
.3 Where sound concrete is damaged, it is to be repaired to the satisfaction of Departmental Representative with no increase in Contract Amount.
.4 Leave concrete surfaces to be patched and repaired clean and sound.

.12 Where indicated, disassemble non-loadbearing interior partitions and remove Materials from structure. Partitions and walls shall be removed full height to structure above.

.13 Remove interior finishes, such as wall, ceiling and floor finishes, where new finishes are indicated on Contract Drawings.
.1 Removal of existing ceilings shall include complete removal including bulkheads and suspension system.
.2 Removal of adhesive applied finishes shall include complete removal to substrate including adhesive. Take adequate care to prevent damage to substrate.
.3 Remove existing floor finishes, include mortar bed, underlayment or other cleavage membranes, underpad, base, floor moulding and transition strips.

.14 Wherever possible, transfer Material assemblies from heights to ground level for easier disassembly. Take appropriate measures to ensure safety.

.15 Separate from waste stream, Material in condition suitable for reuse and/or recycling.

.16 Salvaged items: Remove and store Materials to be salvaged, in manner to prevent damage.
.1 Store and protect in accordance with requirements for maximum preservation of Material.
.2 Handle salvaged Materials as new Materials.
.3 List and description of items to be removed, stored or reused:
.1 Rainwater drains.
.2 Wood doors and door hardware.
.3 Wood casings.
.4 Baseboards.
.5 Metal sash windows.
.6 Additional items as indicated on drawings or by the Departmental Representative.
.7 Owner's equipment to be reused; refer to schedule and drawings.
.8 Diesel generator day tank.
.9 Kitchen appliances.

.17 Separate from source recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt.

.18 Remove Materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

.19 Where existing Materials are to be re-used in Work, use special care in removal, handling, storage and re-installation to assure proper function in completed Work.

3.6 PROCESSING

.1 Designate location for processing of Materials which eliminates double handling and provides adequate space to maintain efficient Material flow.

.2 Separate Materials to ensure best possible condition of salvaged Materials.

.3 Keep processing area clean and free of excess debris.

.4 Supply separate, marked disposal bins for categories of waste Material. Do not remove bins from site until inspected and approved by Departmental Representative. Notify Departmental Representative prior to removal of bins from site.

.5 Separate processed Materials into organized piles for stockpiling. Provide collection area for Materials to be processed or for alternate disposal. Pile Materials on pallets to facilitate transport off-site and to storage areas.

3.7 STOCKPILING

.1 Label stockpiles, indicating Material type and quantity.

.2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.

.3 Locate stockpiled Materials convenient for use in new construction. Eliminate double handling wherever possible.

.4 Stockpile Materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.8 REMOVAL FROM SITE

.1 Transport Material designated for alternate disposal to approved facilities listed in waste reduction workplan and in accordance with applicable regulations. Do not deviate from facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.

.2 Dispose of Materials not designated for alternate disposal in accordance with applicable regulations. Disposal facilities must be approved of and listed in waste reduction workplan. Do not deviate from disposal facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.

3.9 RESTORATION

.1 Upon completion of project, restore and reinstate areas affected by Work to match condition of adjacent, undisturbed areas.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.
.2 Remove debris, trim surfaces and leave Work site clean, upon completion of Work
.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.11 PROTECTION

.1 Repair damage to adjacent Materials or property caused by demolition.

END

PART 1- GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00: Concrete Reinforcing.

.2 Section 03 30 00: Cast-in-Place Concrete.

.3 Section 03 64 00: Concrete Repair.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):
- .1 CSA A23.1:19/A23.2:19, Concrete materials and methods of concrete construction / Test methods and standard practices for concrete.
- .2 CSA O325-16, Construction Sheathing.
- .3 CSA O437 SERIES-93 (R2011), Standards on OSB and waferboard.
- .4 CSA S269.1-16, Falsework and formwork.
- .5 CSA O121-17, Douglas fir plywood.
- .6 CSA O153:19, Poplar plywood.

.2 American Concrete Institute (ACI):
- .1 ACI SPEC-117-10: Specification for Tolerances for Concrete Construction and Materials (ACI 117-10) and Commentary-Reapproved 2015.
- .2 ACI PRC-347.3R-13 Guide to Formed Concrete Surfaces.

.3 American Society for Testing and Materials (ASTM):
- .1 ASTM D4819-13, Standard Specification for Flexible Cellular Materials Made from Polyolefin Plastics.
- .2 ASTM C900-19, Standard Test Method for Pullout Strength of Hardened Concrete

1.3 QUALITY ASSURANCE

.1 Submit samples in accordance with Section 03 30 00.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

PART 2- PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Design in accordance with CSA S269.1.

.2 Departmental Representative accepts no responsibility for structural adequacy of formwork and will not review its design.

2.2 MATERIALS

.1 Formwork materials: to CSA S269.1.
  .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CSA O437 Series or CSA O153.
  .2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.
  .3 Form ties:
    .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm (1”) diameter in concrete surface.
    .2 Snap ties to snap cleanly at least 25 mm (1") from concrete surface without damage to the concrete.
  .4 Form liner: high density overlay plywood to CSA O121 or other special materials to achieve the required concrete finish.
  .5 Form release agent: non-toxic, low VOC, chemically active agent containing compounds that react with free lime in concrete resulting in water insoluble soaps.
  .6 Form stripping agent: colourless mineral oil, non-toxic, low VOC, free of kerosene, with viscosity between 15 to 24 mm^2/s (70 and 110s Saybolt Universal) at 40°C, flashpoint minimum 150°C, open cup.
  .7 Grooves, reglets and chamfers: White pine selected for straightness and accurately dressed to size.

.2 Compressible filler: flexible polyethylene closed cell expansion joint filler to ASTM D4819, type II.

PART 3- EXECUTION

3.1 FABRICATION AND ERECTION

.1 Conform to CSA A23.1/A23.2.

.2 Do not place shores and mud sills on frozen ground.

.3 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.4 Fabricate and erect formwork in accordance with CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.

.5 Make formwork tight and flush faced to prevent the leakage of mortar and the creation of unspecified fins or panel outlines.

.6 Form sides of footings.

.7 Obtain Departmental Representative approval for formed openings, slots and chases not indicated on Structural Drawings.

.8 Do not permit loads from formwork to be transmitted to adjacent existing structure.

.9 Apply a form coating and release agent uniformly to the contact surface of formwork panels before reuse.

.10 Use 25 mm (1”) chamfer strips on external corners and 25 mm (1”) fillets at interior corners, unless specified otherwise.

.11 Form chases, slots, openings, drips, recesses and control joints as indicated on Architectural and Structural drawings.

.12 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.13 Anchors and inserts not to protrude beyond surfaces designated to receive applied finishes, including painting.

.14 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.

.15 Build top form on sloping concrete where required to prevent concrete from flowing out of the form. Provide vents to allow air and bleed water to escape.

.16 Do not close wall forms before reinforcing steel has been reviewed by Departmental Representative.

3.2 JOINTS

.1 Refer to Typical Details and Drawings Notes for locations, detailing and maximum spacing requirements of all concrete joints.

.2 Refer to Section 03 30 00 for construction joints, sawcut joints and isolation joints in slab on grade and concrete toppings.

3.3 ARCHITECTURAL CONCRETE

.1 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.2 Ensure members have sharp and accurate definition of corners, reglets, etc. and are free from chips and spalls.

3.4 FIELD QUALITY CONTROL

.1 Refer to Section 01 45 00.

.2 Obtain field review of falsework and reshoring by the Professional Engineer responsible for that work prior to each pour. Departmental Representative will not field review the formwork, falsework or reshoring.

.3 An independent Inspection and Testing Agency will be appointed to inspect all features of formwork affecting appearance of finished architectural concrete surfaces for conformance with Contract documents.

3.5 REMOVAL AND RESHORING

.1 Conform to CSA A23.1/A23.2 and to ACI 347.

.2 Use pullout tests, on-site cured cylinders (kept beside and treated as the concrete in the structure they represent) or maturity tests to determine in-situ strength of concrete prior to removal of falsework. Do not locate pullout inserts on concrete surfaces exposed to view. Retain a testing company to supply, locate and test the inserts in accordance with ASTM C900.

.3 Maintain falsework supporting beams until concrete has reached at least 75% of its specified strength.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00: Concrete Forming and Accessories.

.2 Section 03 30 00: Cast-in-Place Concrete.

.3 Section 03 64 00: Concrete Repair.

.4 Section 32 16 00: Curbs, Gutters and Sidewalks.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):
.1 CSA A23.1:19/A23.2:19, Concrete materials and methods of concrete construction / Test methods and standard practices for concrete.
.2 CSA A23.3:19, Design of Concrete Structures.
.3 CSA G30.18-09(R2019), Carbon Steel Bars for Concrete Reinforcement.
.4 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.5 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.2 Reinforcing Steel Institute of Canada (RSIC):
.1 Reinforcing Steel Manual of Standard Practice.

.3 American Concrete Institute (ACI):
.1 ACI SP-66-04: ACI Detailing Manual.

.4 ASTM International Inc.:
.1 ASTM A1064/A1064M-18a, Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
.2 ASTM A775/A775M-19, Standard Specification for Epoxy-Coated Reinforcing Steel.
.3 ASTM D3963/D3963M-15, Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
.4 ASTM A955/A955M-20c, Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement.
.5 ASTM A1064/A1064M-18a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete,

1.3 QUALITY ASSURANCE

.1 Qualifications
.1 Welding of reinforcing steel to be performed by welders certified under CSA W186.

1.4 QUALITY CONTROL

.1 Submit in accordance with Section 01 45 00.

.2 Source Quality Control Submittals:
.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
.2 Upon request, inform Departmental Representative of proposed source of reinforcement material to be supplied.
.3 Upon request, provide Departmental Representative with a copy of plant certificate by the Concrete Reinforcing Steel Institute for epoxy coating of reinforcement.
.4 Upon request, provide Departmental Representative with a copy of manufacturer's instructions for patching factory applied epoxy coating.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's data sheets for mechanical rebar splices.

.3 Shop Drawings:
.1 Prepare shop drawings in accordance with RSIC Manual of Standard Practice unless the Contract Documents contain a more stringent requirement. Conform to ACI SP-66 Detailing Manual whenever a detail condition is not covered by any of the above.
.2 Submit plans, elevations, sections and details necessary to fabricate, place and review reinforcement without reference to structural drawings, including masonry wall reinforcement. Draw to scale not smaller than 1:50 (1/4" = 1'-0").
.3 Show on drawings:
.1 Sizes, spacings and locations of reinforcement, with identifying labels.
.2 Bar bending details.
.3 Lengths and locations of all lap splices.
.4 Types and locations of mechanical splices.
.5 Placing sequence.
.6 Bar lists.
.7 Quantities of reinforcement (including all rebar added to accommodate installation).
.8 Construction joint and control joint locations.
.9 Concrete cover.
.4 Do not release for fabrication reinforcing bars whose length may be affected by field conditions, such as the final elevation of footings, until obtaining the required field measurements.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Reinforcing steel: carbon steel, deformed bars to CSA G30.18, unless

indicated otherwise.

.2 Weldable Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.

.3 Stainless Reinforcing steel: deformed bars to ASTM A955/A955M.

.4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.

.5 Welded steel wire fabric: to ASTM A1064/A1064M. Provide in flat sheets only.

.6 Epoxy Coating of reinforcement: to ASTM A775/A775M.

.7 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

.8 Mechanical splices: to concentrically align bars and develop specified tensile strength of rebar. Threaded couplers to have plastic internal coupler thread protectors.

.9 Rebar terminators: oversized taper-threaded couplings capable to develop specified tensile strength of rebar; area to be not less than 5 times the rebar area.

.10 Plain round bars: to CSA G40.20/G40.21.

PART 3- EXECUTION

3.1 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice.

.2 Fabricate epoxy coated reinforcing steel in accordance with ASTM D3963/D3963. Plants to be certified by the CRSI for epoxy coated steel. Provide colour to contrast sharply with reinforcing steel and rust colour.

.3 Stagger mechanical splices 750 mm (2’-6”) unless otherwise noted on drawings.

.4 Weld reinforcement in accordance with CSA W186, where indicated.

.5 Ship bundles of bar reinforcement, clearly identified in accordance with bar lists.

.6 Provide standard hooks at ends of all hooked bars.

.7 Unless a specific stirrup shape is indicated on plans or schedules, all stirrups to be closed hoops.

.8 Substitute different size bars only if permitted in writing by

Departmental Representative.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure. Use tools which will limit bend radii to the values given in CSA A23.1/A23.2.

.3 Where key-creating stay form with pre-installed blind dowels is used, bend the dowels out using special tools approved by the stay form manufacturer.

.4 Replace bars which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1/A23.2.

.2 Remove all loose scale, dirt, oil or other coatings which would reduce bond.

.3 Ensure cover to reinforcement is maintained during concrete pour.

.4 Turn ends of tie wire towards the interior of concrete.

.5 Support bars, chairs and spacers:
.1 Provide sufficient support bars, chairs, carriers and side form spacers as necessary to secure against displacement of reinforcement and maintain concrete cover before and during concrete placement. Support devices contacting surfaces exposed to the exterior to be non-corroding. Bars which are not shown on Structural Drawings and whose only function is supporting other reinforcing in lieu of other supporting devices to be considered accessories.
.2 Use bar supports for beams and slabs.
.3 Use plastic or plastic tipped bar supports and spacer with colour to match concrete for exposed concrete surfaces.
.4 Use plastic bar supports, epoxy coated support bars and plastic coated tie wire for epoxy coated reinforcement.
.5 Use precast concrete chairs where supports rest on the ground. Where welded wire fabric is used in slabs-on-grade, place precast concrete chairs at 600 mm (2’-0”) on centre each way. Do not attempt to position welded wire fabric by lifting it after concrete is poured.

.6 Do not splice reinforcing at locations other than shown on placing or structural drawings without Departmental Representative written approval.

.7 Do not cut reinforcement without Departmental Representative written

approval.

.8 Bars marked continuous to be terminated in standard hooks at ends and spliced using class b laps. for lap lengths and development lengths, refer to typical details TC-REINF-01.

.9 Where two bars of different size are lapped in tension, splice length to be equal to the smaller bar's tension lap splice, or to the larger bar's tension development length, whichever is longer.

.10 Unless otherwise noted on drawings, stagger alternate mechanical couplers 750 mm (2’-6”) apart.

.11 Install end bearing compression splices so that bearing ends are fitted to within 3 degrees of full bearing after splice installed.

.12 Lap welded wire fabric sheets by one spacing of cross wires +50 (2”), measured between the outermost cross wires in each sheet.

.13 Place welded wire fabric in slabs on grade at 1/3 slab thickness below top of slab. provide adequate chairs to keep in specified position. lifting WWF after concrete is poured to bring it in position is not acceptable

.14 Minimum clear spacing between adjacent bars to be at least 1.4 times the bar diameter or 1.4 times the nominal maximum size of the coarse aggregate, whichever is more.

.15 Minimum concrete cover to principal reinforcement to be as follows (also refer to typical detail TC-RENF-21):
.1 Where concrete is cast against and permanently exposed to earth, minimum concrete cover to reinforcing bars closest to the concrete surface to be 75 (3”).
.2 for class N concrete, minimum concrete cover to reinforcing bars closest to the concrete surface to be 40 (1-1/2”) for beams and columns and 25 (1”) for slabs and walls.
.3 For class C-1 concrete, minimum cover to be 60 (2 1/2”).
.4 For class F-1 and F-2 concrete, minimum cover to be 40 (1 1/2”).
.5 increase cover where required to maintain minimum ratio of cover to nominal bar diameter of 1 for class N, 1.5 for classes F1, and 2 for class C1.

.16 For bars with 90° hooks, provide 50 (2”) cover on the bar extension beyond the hook (from the hooked portion to face of concrete).

.17 Where parallel reinforcement is placed in two or more layers, position bars in upper layer directly above the bars in lower layer, maintaining the minimum clear spacing between layers as specified above.

.18 Do not field weld reinforcement except where indicated or authorized by Departmental Representative.

.19 Do not weld epoxy coated reinforcement.

3.4 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00: Concrete Forming and Accessories.

.2 Section 03 20 00: Concrete Reinforcing.

.3 Section 03 64 00: Concrete Repair.

.4 Section 05 12 23: Structural Steel for Buildings.

.5 Section 09 67 72: Concrete Floor Sealer.

.6 Section 31 66 15: Helical Foundation Piles.

.7 Section 32 16 00: Curbs, Gutters and Sidewalks.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):
- .1 CSA A23.1:19/A23.2:19, Concrete materials and methods of concrete construction / Test methods and standard practices for concrete.
- .2 CSA A283:19, Qualification Code for Concrete Testing Laboratories.
- .3 CSA A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.2 ASTM International Inc.:
- .1 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .2 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants
- .3 ASTM E1155-20, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
- .4 ASTM C578-19, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- .5 ASTM D2240-15e1, Standard Test Method for Rubber Property—Durometer Hardness.
- .6 ASTM D638-14, Standard Test Method for Tensile Properties of Plastics
- .7 ASTM C457/C457M-16 Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.
- .8 ASTM E1155M-14 Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric)

1.3 QUALITY ASSURANCE

.1 Qualifications
- .1 Concrete supplier to have a valid “Certificate of Ready Mixed Concrete Production Facilities” issued by the relevant Ready Mixed Concrete Association.

1.4 QUALITY CONTROL

.1 Submit in accordance with Section 01 45 00.

.2 Minimum two weeks prior to starting concrete work, provide valid certificate from plant delivering concrete.
- .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.3 Minimum four weeks prior to starting concrete work, provide proposed quality control procedures on following items:
- .1 Hot weather concrete.
- .2 Cold weather concrete.
- .3 Finishing.
- .4 Protection.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meeting: convene pre-installation meeting one week prior to beginning concrete works. Ensure key personnel to attend.

.2 Batch Logs: keep record of each batch delivered to site.

.3 Concrete Delivery Slips: Keep all concrete delivery slips (“driver’s tickets”) on site until building is completed. Record on delivery slip where concrete was placed, including time and date.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Minimum 2 weeks prior to starting concrete work, submit all concrete mix designs, and indicate where each concrete mix is to be used.

.3 Minimum 2 weeks prior to placing concrete, submit drawings showing proposed locations of all construction and control joints (slab on grade control joints) for Departmental Representative review and approval.

.4 Minimum submission requirements for each concrete mix design shall include the following:
- .1 Minimum specified compressive strength at 28 days (or at the time specified on drawings).
- .2 Maximum aggregate size.
- .3 Aggregate type (if not normal density).
- .4 Concrete density range, wet and dry (if not normal density).
- .5 CSA exposure class.
- .6 Cement type (if not type General Use).
- .7 Percentage and type of supplemental cementing materials.
- .8 Maximum water/cementitious materials ratio.
- .9 Assumed method of placement of concrete.
- .10 Corrosion inhibitor (name and quantity, if applicable).

.11 Alkali-aggregate resistance.
.12 Architectural requirements (colour of cement and aggregate, if applicable).
.13 Maximum time from batching to placing concrete (if retarding admixtures are used).

.5 Concrete pours: provide accurate records of all concrete pours marked on a set of Structural Drawings.

.6 Flatness and levelness: submit measurements of slab tolerances for each concrete pour (as applicable).

.7 On completion of the works, provide written report to Departmental Representative certifying that the concrete in place meets performance requirements established in PART 2 - PRODUCTS.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

.1 To CSA A23.1/A23.2, Alternative 1 – Performance, and as described under Mixes and on Structural Drawings.

2.2 PERFORMANCE CRITERIA

.1 Concrete supplier to meet the concrete performance criteria established by Departmental Representative and to provide verification of compliance.

2.3 MATERIALS

.1 Portland cement: to CSA A3001, type GU unless noted otherwise or required by exposure class.

.2 Cementitious hydraulic slag: to CSA A3000.

.3 Fly ash: to CSA A3001, Type CI.

.4 Water: to CSA A23.1/A23.2.

.5 Aggregates: to CSA A23.1/A23.2, nominal maximum size of coarse aggregate to be 20 (3/4”) unless noted otherwise. Do not use recycled concrete as aggregate. Exposed pebble aggregate: 3mm to 6mm grey aggregate and matrix to match aggregate colour.

.6 Admixtures: not to contain chlorides.

.7 Corrosion-inhibiting admixture: calcium nitrite solution.

.8 Non premixed dry pack grout: composition of nonmetallic aggregate and Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive

strength of 40 MPa at 28 days.

.9 Curing/sealing compound: to CSA A23.1/A23.2 and ASTM C309, Type 1, Class B, water based acrylic, compatible with surface hardener where hardener is used.

.10 Floor surface hardener: non-metallic, natural grey colour (unless other colour is requested by the departmental representative), premixed, Mohs Hardness 7 or better.

.11 Pre-moulded joint fillers: min.12 (1/2") bituminous impregnated fiber board to ASTM D1751.

.12 Joint Sealants: to ASTM C920, class 100/50.

.13 Weep hole tubes: plastic.

.14 Evaporation reducer: water based polymer liquid forming continuous monomolecular temporary film on fresh concrete surface.

.15 Penetrating sealer: water based, clear water repellent, at least equivalent to AT&U Type 1b.

.16 Rigid insulation: extruded polystyrene boards per ASTM C578, structural grade, compressive strength 40 psi (275 kPa).

.17 Control joint filler: semi-rigid two component epoxy or polyurea with 100% solids, Shore A hardness (per ASTM D2240) min. 85, tensile strength at 7 days (per ASTM D638) min 5.0 MPa.
.1 For saw cuts in exterior slabs and in slabs in vehicle accessible areas use only polyurea fillers.

.18 Pre-formed control joint: two piece pre-assembled "T" shaped plastic; detachable top segment, minimum depth of horizontal segment equal to ¼ of slab thickness.

.19 Prefabricated Seepage Protection System: polymer core with a geotextile laminated on one side.

.20 Bond Breaker: 0.25 mm (10 mil) polyethylene or grade D, 30 minute building paper perforated with 8 mm (5/16") holes at 150 mm (6") centres, each way.

2.4 CONCRETE MIXES

.1 Use ready-mix concrete. Proportion concrete in accordance with CSA A23.1/A23.2, Alternative 1 - Performance Method for Specifying Concrete.

.2 Set performance characteristics of concrete in plastic state in coordination with all trades involved.

.3 Meet performance criteria of concrete in hardened state as shown on Structural Drawings and provide verification of compliance.

.4 Use water-reducing agent in all concrete.

.5 Do not use admixtures containing chlorides.

.6 Concrete to be normal density (min. 2300 kg/m3) unless noted otherwise.

.7 Supplementary cementing materials (SCM):
.1 Conform to CSA A23.1/A23.2.
.2 Follow slag and fly ash manufacturers' directions for proportioning and mixing of concrete.
.3 Avoid using SCM in architecturally exposed concrete. If necessary to achieve the required exposure classification, SCM not to affect colour and texture of finished concrete.
.4 Do not use concrete with more than 40% of SCM when ambient temperature is forecast to be below +10°C at the time of concrete pour and during the seven days after the pour, except for footings, walls and columns.
.5 Reduce W/C ratio to 0.45 where using more than 40% of SCM in concrete for slabs and other horizontal finished surfaces, in order to reduce bleed water and to increase rate or strength gain.

.8 Slabs on grade (unheated and exposed to vehicle traffic):
.1 Exposure class: C1.
.2 Minimum compressive strength at 28 days: 35 MPa.
.3 At reinforced slabs on grade provide corrosion inhibitor with minimum dosage of corrosion inhibitor is 10L/m3 of 30% solution of calcium nitrite.

.9 Grade Beams:
.1 Exposure class: C1.
.2 Minimum compressive strength at 28 days: 35 MPa.

.10 Pile caps and exterior wall bond beams:
.1 Exposure class: F2.
.2 Minimum compressive strength at 28 days: 35 MPa.

.11 Lean concrete, mud slabs:
.1 Exposure class: N.
.2 Minimum compressive strength at 28 days: 10 MPa.

.12 Unshrinkable fill:
.1 Minimum compressive strength at 28 days: 0.4 MPa.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Provide advanced notice as indicated on drawings to allow Departmental Representative field review of reinforcing prior to placing of concrete/closing of wall forms.

.2 Obtain written approval of each foundation bearing surface by the

Departmental Representative before placing concrete.

.3 Remove water and disturbed soil from excavations before placing concrete.

.4 Before placing slab-on-grade, confirm that subgrade and backfill meet specifications and are free of frost and surface water.

.5 Place concrete reinforcing in accordance with Section 03 20 00.

3.2 INSTALLATION/APPLICATION

.1 Set sleeves, conduits, pipe hangers, weep hole tubes, drains and other inserts and openings as indicated or specified elsewhere.

.2 Refer to Typical Details and Drawing Notes for placing guidelines, maximum size and minimum spacing of sleeves, embedded pipes and conduits.

.3 Check locations and sizes of sleeves and openings shown on Structural Drawings with Architectural, Mechanical and Electrical Drawings. Notify Departmental Representative of any discrepancies.

.4 Provide composite sleeving drawings showing sleeves required by all trades. Obtain Departmental Representative approval for any required sleeves and openings which are not shown on Structural Drawings.

.5 Set special inserts for strength testing as required for non-destructive method of testing concrete.

.6 Set anchor rods using templates under supervision of appropriate trade prior to placing concrete. Locate each anchor rod group to within 6 mm (1/4”) of required location.

.7 Refer to Section 03 10 00 for construction joint requirements.

3.3 PLACING CONCRETE

.1 Place concrete in accordance with CSA A23.1/A23.2.

.2 Delivery and place concrete with minimum re-handling.

.3 If concrete is pumped or placed pneumatically, control discharge velocity to prevent separation or scattering of concrete mix ingredients.

.4 Place concrete in a continuous operation without cold joints. If cold joints develop inadvertently, notify Departmental Representative to obtain instructions for required remedial work.

.5 Cast slabs with a top surface that is level or sloping as required by the Drawings.

.6 Do not add water to concrete on site.

.7 Convey concrete from truck to final location by methods which will prevent separation or loss of material. Maximum free fall not to exceed 1.5m (5'-0"). Consolidate concrete using mechanical vibrators.

.8 Place concrete as close as possible to final location to avoid segregation. Vibrate all concrete.

.9 Concrete exposed to view:
.1 Exposed surfaces to be dense, even, uniform in colour, texture and distribution of exposed aggregate.
.2 Defects such as honeycombing, voids, loss of fines, visible flow lines, cold joints or excessive bug holes may be cause for rejection at the discretion of the departmental representative.

.10 Maintain accurate records of all poured concrete including extent, date and location of each pour, concrete mix used, ambient air temperature and test samples taken on a set of Structural Drawings.

3.4 FINISHING CONCRETE

.1 Finish concrete to CSA A23.1/A23.2.

.2 Cooperate with any trade applying finishes to concrete surfaces and provide surfaces which will ensure adequate bond. Provide chases and reglets where required.

.3 Finishing Flatwork:
.1 Protect concrete during finishing process. Use evaporation reducer during severe drying conditions.
.2 Provide final finish in accordance with proposed use and as follows:
.1 Screeded and bull floated for: mud slabs and footings/pile caps.
.2 Wood float finish with brooming for: exterior exposed slabs – non Architectural Exposed Concrete.
.3 Powered steel trowel finish for: interior exposed slabs, slabs which receive resilient flooring, carpet, epoxy-based finishes, thin-set tiles, etc. and future floors. Do not trowel air entrained concrete.
.4 Steel trowel exposed interior concrete floors at least twice. Provide final spin troweling when non-slip finish is required.
.5 Pebble finish for Architectural Concrete: pebble aggregate and matrix to match colour and providing a consistent appearance. Surface texture to be slip resistant. Screed concrete surface to slope minimum 6mm in 3m. Finish panel edges with edging tool. Expose pebbled surface by washing and brushing away surface mortar.
.3 Surface hardeners:
.1 Provide where hardened concrete is required by

Architectural Drawings or Specifications.

.2 Use only liquid hardeners (or integral hardeners) on air entrained concrete; do not use dry-shake applied surface hardeners.

.3 Incorporate hardener into the surface of the concrete while concrete is still plastic.

.4 Follow manufacturer's recommendations for dosage and application procedure.

.5 Where coloured hardeners are required, colour will be selected from available colours by the departmental representative.

.4 Surface Tolerances:

.1 Concrete surface tolerance to CSA A23.1/A23.2, F-Number method.

.2 Unless otherwise noted, conform to finish tolerance Class A.

.3 Measure surface tolerances within 72h of each concrete pour.

.4 Finishing Formed Surfaces:

.1 Completely fill holes left by through-bolts with grout.

.2 Concrete exposed to view:

.1 Provide smooth-form finish.

.2 Rub exposed sharp edges with carborundum to produce 3 mm (1/8") radius edges unless otherwise indicated.

.3 Architectural Concrete:

.1 Refer to Architectural drawings for concrete elements which are considered Architectural Concrete.

.2 Final appearance of architectural concrete is as important a factor as the engineering properties of the concrete and failure of the as-cast concrete to meet the required standard of appearance may be cause for rejection at the discretion of the departmental representative.

3.5 CONCRETE CURING AND PROTECTION

.1 At a minimum cure and protect concrete in accordance with CSA A23.1/A23.2.

.2 Do not place concrete against frozen ground.

.3 Extend curing and protection period until concrete has reached following strength levels for structural safety:

.1 Framed slabs and beams: 75% of specified 28 day strength.

.2 Piers and footings: 50% of specified 28 day strength

.4 For concrete containing supplementary cementing materials, curing and protection times may need to be extended beyond those outlined by CSA A23.1 to achieve the required structural properties.

.5 Cure slab surfaces immediately after finishing is completed. Unless otherwise noted or required, use a curing compound compatible with

applied finishes.

.6 Slabs on grade receiving resilient floor or other moisture sensitive finishes:
- .1 Apply 24 hours of continuous sprinkling with water. Start immediately after finishing slab.
- .2 Cover slab for at least the following 72 hours using plastic sheets with joints taped and free edges covered.
- .3 Protect finished and cured slab from surface water (i.e. rain, snow).

.7 Concrete exposed to view:
- .1 Protect during construction period from wear, damage, marking, discolouration, staining and becoming coated with concrete leakage.
- .2 Unless rejected, repair damage and remove marks and stains to the approval of the departmental representative.

.8 Do not load concrete until sufficient strength is developed.

3.6 SLABS ON GRADE

.1 Construction joints and control joints:
- .1 Refer to Notes on Structural Drawings for maximum spacing requirements.
- .2 Saw cut control joints to depth equal to one quarter of the concrete thickness u/n. Alternatively, for slabs on grade not exposed to view or vehicle traffic, create control joints by inserting pre-assembled “T” shaped plastic joints into fresh concrete; remove top part prior to concrete finishing.
- .3 Locate joints on column lines wherever possible and on intermediate lines, which result in approximately square panels, without re-entrant corners.
- .4 Do not create “L” shaped panels nor “T” shaped joint intersections.
- .5 Protect edges of sawcuts from breakage.
- .6 Clean out sawcuts in concrete exposed to view or vehicle traffic and fill with control joint filler after concrete is at least 120 days old.
- .7 Sawcut top 25 mm (1") at construction joints in exposed concrete for a width of 5 mm (3/16") and fill with control joint filler after concrete is at least 120 days old. Alternatively, form construction joint with a 5mm (3/16”) thick chamfer strip at top. Depth of the strip to be at least equal to 1/4 of slab thickness.
- .8 Clean out sawcuts in other concrete and fill with a sand-cement paste one month prior to installing floor coverings.
- .9 Unless noted otherwise, provide construction joints at 30m (100ft) maximum in both directions, with control joints in between at 25 times the slab thickness, but not more than 5m (15ft). Longer dimension of any sog segment created by construction and control joints not to exceed 1.25 times the shorter dimension of the segment. Consider slab depressions and pits when proposing layout, and show on layout drawings. Complete sawcutting within 6 to 18 hours of placing concrete.

.2 Isolation Joints:
.1 Unless otherwise shown on structural drawings, provide min.10 mm (3/8”) thick pre-moulded joint filler of the same depth as the thickness of the concrete wherever slabs-on-grade abut foundation walls, columns and piers. Omit if slab is chased or dowelled into structure.
.2 Furnish filler for each joint in single piece for depth and width required for joint.
.3 When more than one piece of filler is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Cracks in Slabs-on-Grade:
.1 Extensive cracking of slabs-on-grade or cracks in excess of 3 mm (1/8”) in width may be cause for rejection of slab or portion of slab at the departmental representative’s discretion.
.2 Protect edges of cracks in slabs-on-grade from breakage.
.3 Exposed slab on grade: Unless slab is rejected, repair cracks that are over 0.4 mm (0.016") wide:
.1 Fill cracks with a sand-cement grout after concrete is at least 120 days old.
.2 Seven days later, cut out top 20 mm (3/4") of crack for a width of 5 mm (3/16") and fill with control joint filler.
.4 Architectural slab on grade: Unless slab is rejected, repair cracks that are over 0.2 mm (0.008") wide:
.1 Fill cracks with epoxy after concrete is at least 180 days old.
.2 Take all measures necessary to prevent epoxy on surface of exposed slab.
.3 Have manufacturer’s technical representative present during initial repairs.

3.7 CONSTRUCTION JOINTS

.1 Provide joints where specified or shown on drawings. Locate so as not to impair the required strength of the structure. Submit joint layout for the departmental representative review and approval a minimum of 2 weeks prior to pouring concrete. Refer to typical details and specifications for additional information.

.2 Unless otherwise noted, provide standard continuous 38 x 89 (2x4) formed keys at all construction joints. center at joints and chamfer sides.

3.8 PENETRATING SEALER

.1 Concrete to receive penetrating sealer to be at least 28 days old.

.2 Surfaces to be treated with the sealer to be dry and free of dirt and other contaminants.

.3 Completely remove all curing compounds before the sealer application.

.4 Follow manufacturer's recommendations for coverage rate and application procedure.

.5 Use sealers approved for exterior use for all exposed flatwork.

.6 Sealant: multi-component, chemical curing, with compatible primer for concrete, bearing Ecologo to ECP/PCE-45.

.7 Do not apply in inclement weather or if ambient air temperature or concrete surface temperature is less than 5°C or more than 38°C.

3.9 GROUTING UNDER BASE PLATES AND BEARING PLATES

.1 Grout under base plates and bearing plates using procedures in accordance with manufacturer's recommendations.

.2 Provide 100% contact over grouted area.

.3 Grout column base plates and beam bearing plates as soon as steelwork is completed.

.4 Do not add load on steelwork until grouting is completed and grout strength has reached at least 20 MPa.

3.10 EXISTING STRUCTURE

.1 Take precautions to protect the existing structure from damage.

.2 Provide temporary shoring and bracing as required.

.3 Retain a Professional Engineer to design the temporary shoring and bracing and to review this work on site.

.4 Obtain approval from Departmental Representative before coring or cutting.

.5 Retain an independent testing company to locate existing reinforcement and conduit in the areas of proposed openings and to mark locations on the surfaces of slabs and walls on which the cores and cuts are to be started using a non-destructive method.

.6 Mark locations and sizes of cores and openings and locations of reinforcement and conduit using indelible markers as follows:
.1 Red for top bars.
.2 Green for bottom bars.
.3 Black for cores, openings and conduit.

.7 Relocate proposed openings and repeat process at no extra cost to the Contract if proposed locations are not acceptable to Departmental Representative.

.8 Save the complete length of all cores. Label each core with location

taken. Make all cores available for review by Departmental Representative. Dispose of cores only with approval of Departmental Representative. See details on structural drawings for sawcutting procedure.

.9 Patching:

.1 Patch existing concrete where necessary to provide required smooth, flat surfaces for other trades.

3.11 INSPECTION AND TESTING:

.1 An independent Inspection and Testing Agency (certified under CSA A283 with category to suit testing provided) will be appointed to carry out inspection and testing of concrete and concrete materials and check conformance with applicable Standards and Contract documents.

.2 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required. Provide concrete samples.

.3 The Agency will submit reports covering the work inspected and the testing performed. The reports will include the Supplier's mix design numbers, locations in structure to which the tests relate and comments on abnormal results and conditions. The reports will be provided not later than five working days after the testing is completed.

.4 Sampling, storing, curing and testing of concrete will be in accordance with CSA A23.1/A23.2.

.5 The Agency will measure slab surface tolerances (flatness and levelness) using the F-Number system in accordance with ASTM E1155M. Measurements to be made a maximum of 72 hours after every slab pour.

.6 Compressive Strength Testing:

.1 One test is required for each 100 cubic meters of placed concrete, but not less than one test for each concrete mix placed each day. At least 3 tests are required for each class of concrete used.

.2 A group of three cylinders for each test will be provided, Location of concrete placement will be recorded for each cylinder set. One specimens will be tested at 7 and one at 28 days. The third specimen will be tested at 56 days if the required strength at 28 days is not achieved.

.3 One additional cylinder will be provided for each concrete mix during cold weather concreting. The specimens will be cured on site adjacent to and under the same conditions as the work they represent, and will be tested prior to form removal.

.4 If standard on site cured cylinders are used to determine concrete strength prior to removal of formwork, they will be kept adjacent to and under the same conditions as the work they represent.

.7 Air Entrainment Testing:

.1 One standard test for air content in plastic concrete will be conducted for each 100 cubic meters of each air entrained concrete

mix.

.2 One standard test per ASTM C457 will be conducted to determine air void spacing factor in hardened concrete for each 100 cubic meters each air entrained concrete mix. Rang of air content as per CSA A23.1/A23.2 for specified class of exposure.

.8 Permeability Testing:

.1 One chloride ion permeability test will be conducted for each 100 cubic meters of class C-1 concrete mixes used for floor slabs.

.9 Inspection and testing by the Agency will not augment or replace the Contractor’s quality control nor relieve him of his contractual responsibility.

PART 1 - GENERAL

1.1 REFERENCES

.1 American Concrete Institute (ACI).
.1 ACI 347R-13, Guide to Formwork for Concrete Surfaces

.2 ASTM International (ASTM).
.1 ASTM C109/C109M-20b, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
.2 ASTM C157/C157M-17, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
.3 ASTM C348-20, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
.4 ASTM C469/A469-14, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
.5 ASTM C496/C496M-17, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
.6 ASTM C666/C666M-15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
.7 ASTM C672/C672M-12, Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
.8 ASTM C1012/C1012M-18b, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
.9 ASTM C1202-19, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.3 Canadian Standards Association (CSA)
.1 CSA A23.1:19/A23.2:19, Concrete Materials and methods of concrete construction/Test methods and standard practices for concrete.
.2 CSA 0121-17, Douglas fir plywood.
.3 CSA S269.1-16, Falsework and formwork.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide electronic copies of most recent technical Product data sheets for proposed concrete repair Materials describing Materials', physical properties and include product characteristics, performance criteria, physical size, finish, limitations, storage, handling and installation requirements.
.2 Provide two copies of WHMIS SDS, and indicate VOC content for each product.

.3 Provide shop drawings:
.1 Provide methodology for concrete repair and patching including removals, disposal, proposed equipment, Products, repair techniques, curing, and all other elements required to repair and patch existing substrates.

.2 Provide sections, details, Materials, dimensions, details of concrete repair techniques and surface finishes.

.4 Manufacturer's Certificate: certify that products meet or exceed specified requirements and is intended for the purpose it is being used.

1.3 QUALITY ASSURANCE

.1 Mock-up:
.1 Provide mock-ups in accordance with Section 01 45 00.
.2 Provide mock-ups for each repair type and finish using identical project Materials and methods proposed for repair Work.
.3 Mock-up will be used: To judge quality and workmanship, substrate preparation, Material application, and finish.
.4 Locate where directed.
.5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with repair Work.
.6 When accepted, mock-up will demonstrate minimum standard of quality and workmanship required for this Work. Approved mock-up may remain as part of finished Work.

.2 Convene pre-installation meeting two weeks prior to beginning concrete repair Work, with Contractor's representative, repair product manufacturer, and Departmental Representative in accordance with Section 01 32 16 to:
.1 Verify project requirements.
.2 Review repair methodology, proposed products, installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle Materials in accordance with manufacturer's written instructions and Section 01 61 00.

.2 Storage and Handling Requirements:
.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of concrete repair Materials.
.2 Provide and maintain dry, off-ground weatherproof storage.
.3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.
.4 Remove only in quantities required for same day use.
.5 Place plywood runways over completed Work to enable movement of Material and other traffic.
.6 Store sealants at +5 degrees C minimum.
.7 Store insulation protected from weather and deleterious Materials.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Management and disposal: remove for reuse and return by manufacturer of pallets, crates, padding and packaging Materials in accordance with Section 01 74 20.
.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
.2 Fold up metal banding, flatten and place in designated area for recycling.
.3 Place Materials defined as hazardous or toxic in designated containers.
.4 Place Materials defined as hazardous or toxic waste in designated containers.
.5 Handle and dispose of hazardous or toxic Materials in accordance with Authorities having jurisdiction.

.2 Designate a cleaning area for tools to limit water use and runoff.

.3 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible Material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

1.6 FIELD CONDITIONS

.1 In addition to Cold Weather and Hot Weather Requirements specified in CSA A23.1/A23.2, Do not perform concrete repair Work outside of following environmental ranges without Departmental Representative's and Product manufacturer's written acceptance:
.1 Concrete temperature: 10°C minimum.
.2 Ambient air temperature: 16^0C to 30^0C.
.3 Precipitation: None.

.2 Supply and install temporary protection and facilities to maintain Product manufacturer's, and above specified environmental requirements for 48 hours before, during, and 48 hours after installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

.1 Repaired areas shall not scale, crack or debond from existing concrete.

.2 Surface finish to be smooth board formed or steel troweled finish to match approved mock-ups.

.3 Design, construct, and erect formwork in accordance with CSA A23.1/A23.2, CSA S269.1, ACI 347R, and all applicable construction safety regulations for the place of Work. Formwork to maintain original lines and shape of original concrete.

.4 Build forms sufficiently strong and rigid to sustain the weight or fluid pressure of the concrete without noticeable deflection. Ensure forms are sufficiently tight to prevent leakage of mortar.

.5 Concrete repair Materials shall achieve a minimum compressive strength of 20 MPa within 24 hours.

2.2 MATERIALS

.1 Form Material:
.1 Formwork Material to be sufficient to match board-form mock-up finish.
.2 Exposed surfaces: metal, plywood or plywood lined. Plywood to: CSA 0121.
.3 Unexposed surfaces: metal, plywood to CSA 0121, or wood lumber to CSA 086.1.
.4 Plywood and wood formwork Materials shall conform to CSA S269.1, be free from warp and sawn straight so that lines and shapes will be accurately retained.
.5 Formwork for unexposed surfaces shall be made with a good grade of lumber or plywood and fitted so that there will be no leakage of mortar.
.6 Use metal forms, plywood lined forms or plywood forms of sufficient structural strength for exposed surfaces. Plywood for lining shall be new Material GIS exterior grade fir plywood manufactured with waterproof glue.

.2 Ties and spreaders: Form ties shall be of a type, which are adjustable in length to permit tightening of forms. Use only the snap-off type of form tie, which will leave no metal within 25-mm of the concrete surface after removal. Twisted wire form ties will not be accepted.

.3 Form release agent: Form release agent shall be a pre-approved chemical agent, not an oil based product.

.4 Surface delamination and crack repair concrete mix – silica fume:
.1 Normal weight "ready mixed" Portland cement/silica fume modified concrete mixed in accordance with Section 15, CSA A23.1/A23.2 class of exposure C-1 with the following requirements:
.1 Compressive strength (28 days): 35 MPa minimum.
.2 Air content: 6.0% to 9.0%.
.3 Aggregate size: 6 mm.
.4 Slump:
.1 Prior to superplasticizer 50 mm maximum +/- 20mm.
.2 After superplasticizer 125 mm maximum +/- 25mm.
.5 Water/cementing Materials ratio: 0.40 maximum.
.6 Cement content: 335 kg/m3 minimum.
.7 Cement: Type GU Normal Portland Cement.
.8 Silica Fume: Type U Minimum 7.5 % Silica Fume by mass of cement (21 kg/m3. min.).
.9 Fly Ash – Type F Maximum 15% by mass of cement (42 kg/cu. m. max).
.10 Concrete density Normal weight (2360 kg/m3).
.2 The intent of this mix design is to provide a low permeability, high electrical resistivity concrete mix with a coulomb rating less than 1500.

.3 Non-chloride based plasticizers shall be used to facilitate concrete placement. Costs associated with the use of such Materials shall be included in the contract price. Plasticizer shall be compatible with the air entrainment agent.

.4 Note that although a maximum slump is specified, the Contractor shall endeavor to provide concrete at the minimum slump that permits placement and handling.

.5 Mix design is the responsibility of the Contractor.

.6 Do not add calcium chloride to concrete.

.7 Addition of water to the concrete mix shall not be permitted on-site. The Contractor shall be permitted to adjust only the quantities of superplasticizer and air entraining agent on-site.

.8 No concrete shall be placed later than two (2) hours after the time of batching. No re-tempered concrete shall be allowed.

.9 The Contractor shall use superplaticizers to facilitate concrete placement and must demonstrate to the satisfaction of the Departmental Representative that such admixtures will have no deleterious affect on the durability or strength of the proposed concrete mix (i.e. freeze/thaw durability).

.5 Vertical delamination repair Materials – silica fume:

.1 Vertical and overhead patch Materials to be one component, shrinkage compensating, fibre-reinforced, integral corrosion inhibitor, silica fume enhanced, cementitious, fast-setting, formulated especially for repair of overhead and vertical surface concrete patching with the following minimum criteria at 28 days unless otherwise indicated:

- .1 Dry shrinkage to ASTM C157/C157M: 0.10% maximum.
- .2 Compressive strength to ASTM C109/C109M: 62 MPa minimum.
- .3 Flexural strength to ASTM C348: 9 MPa minimum.
- .4 Splitting tensile strength to ASTM C496/C496M: 9.0 MPa minimum.
- .5 Sulfate resistance at 6 months to ASTM C1012/C1012M: <0.10 %.
- .6 Salt scaling resistance (50 cycles) to ASTM C672/C672M: None.
- .7 Freeze/thaw resistance (300 cycles) to ASTM C666/C666M: 91%.
- .8 Rapid chloride permeability to ASTM C1202: 100-1,000 coulombs.
- .9 Modulus of elasticity to ASTM C469/C469: 34.5 MPa.

.2 Manufacturers' latest product data sheets must be submitted for patch Materials to be used on this project certifying the patch Material conforms to the above specified requirements.

.6 Vertical delamination repair materials – non-silica fume:

.1 Vertical and overhead patch Materials to be two component polymer modified, lightweight, integral corrosion inhibitor, cementitious, formulated especially for repair of overhead and vertical surface concrete patching with the following minimum criteria at 28 day unless otherwise indicated:

- .1 Dry shrinkage to ASTM C157/C157M: 350 maximum.
- .2 Compressive strength to ASTM C109/C109M: 40 MPa minimum.
- .3 Flexural strength to ASTM C348: 9.9 MPa minimum.
- .4 Splitting tensile strength to ASTM C496/C496M: 4.1 MPa minimum.
- .5 Freeze/thaw resistance (300 cycles) to ASTM C666/C666M: 100%.
- .6 Rapid chloride permeability to ASTM C1202: 941 coulombs.
- .7 Modulus of elasticity to ASTM C469/C469: 13.8 MPa.

.2 Manufacturers' latest product data sheets must be submitted for patch Materials to be used on this project certifying the patch Material conforms to the above specified requirements.

.7 Water: potable.

2.3 ADMIXTURES

.1 Use only compatible admixtures and add to mix in strict accordance with manufacturer's recommendations. Use of calcium chloride not permitted.

2.4 MIXES

.1 Mix repair Materials in accordance with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that substrate preparation is acceptable to concrete repair product manufacturer. Commencement of Work of this Section means acceptance of existing conditions.

3.2 PROTECTION OF EXISTING WORK

.1 Provide protective enclosure to Work areas to prevent spread of dust outside Work area. To the extent possible, seal protection at floor, and to ceiling and around ceiling hung mechanical services.

.2 Provide ventilation and other equipment necessary for the safe execution of the Work.

.3 Provide temporary protection for surfaces subjected to concentrated loads before they have cured sufficiently to carry them without damage.

3.3 FORMWORK

.1 Construct forms so that the finished concrete will conform to the shape and dimensions specified.

.2 Construct forms so that they may be dismantled and removed without damaging the concrete.

.3 Use a non-staining form release agent free from volatile constituents for treating forms.

.4 Formwork shall not be removed until the concrete has gained sufficient strength to carry dead loads and all possible construction loads likely to be imposed upon it. Notify the Departmental Representative before removing formwork.

.5 Remove Falsework progressively, in accordance with CSA 269.1 and ensure that no shock loads or unbalanced loads are imposed upon the structure.

3.4 CONCRETE PLACING

.1 Pre-packaged concrete mixes shall be machine mixed. Mixing and placing shall be in accordance with CSA A23.1/A23.2.

.2 Concrete shall be conveyed from the mixer to the place of deposit by methods that will ensure the required quality of concrete. Equipment for conveying the concrete shall be of such size and design as shall ensure a practically continuous flow of concrete at the delivery end without separation of Materials.

.3 Concrete shall be deposited in the forms as nearly as practicable to its final position to avoid rehandling.

.4 Depositing shall be continuous throughout each division and the concrete shall be so placed and worked that a uniform texture will be produced.

.5 No concrete shall be placed later than one half hour after leaving the mixer. No retempered concrete shall be allowed.

3.5 COMPACTION AND VIBRATION

.1 Concrete shall be consolidated by means of sufficient vibrators of adequate size operated by competent workmen.

.2 The use of vibrators to transport concrete shall not be allowed.

.3 Concrete shall be thoroughly worked around reinforcement, around embedded items and into corners of forms, eliminating all air or stone pockets that may cause honeycombing, pitting or planes of weakness.

3.6 CONCRETE CURING

.1 As soon as possible after the concrete has sufficiently set, and no later than 30 minutes after finishing, wet curing with pre-saturated mats shall be initiated on the concrete surfaces.

.1 Wet curing procedures shall ensure that the concrete surfaces shall be kept continuously wet for a period of at least ten (10) consecutive days at a minimum temperature of 10 deg. Celsius. Water shall not be permitted to fully evaporate from the concrete surfaces at any time within the wet cure period.

.2 Minimum acceptable wet curing method is pre-saturated filter fabric, burlap, or cotton mats; covered with soaker hoses and plastic sheeting. Wet-curing mats shall be overlapped 150-mm and held in place without marring the surface of the concrete.

.3 Prevent airflow in the space between the wet-curing mats and the Plastic sheeting. Protect wet-curing assembly from freezing during cold weather.

.2 Vertical repair patches are also to be wet cured, for the duration of the wet-curing period.

.1 Formwork may remain in place on vertical surfaces for the duration of the curing period, however, form ties shall be loosened after the concrete has hardened, and water applied to run down the inside form faces to keep the vertical concrete surfaces wet.

.3 Contractor shall review wet-curing requirements with the Departmental Representative at least 2 weeks prior to first concrete placement. The Contractor must submit any proposed alternate curing methods to the Departmental Representative for review a minimum of one-week prior to placement.

.4 Use of chemical curing compounds shall not be permitted.

.5 Concrete shall be protected from harmful effects of heat, cold, running or surface water, and mechanical shock.

.6 When the air temperature is below 10 deg. C or when in the opinion of the Departmental Representative, there is a possibility of it falling below 10 deg. C no concrete shall be placed until after the Departmental Representative has approved the provisions made to ensure proper curing of concrete. These provisions shall conform to the requirements of CSA A23.1/A23.2.

.7 Adequate equipment shall be provided for heating the concrete Materials and protecting the concrete from freezing or near freezing temperatures. No frozen Materials or Materials containing ice shall be used. All concrete Materials and all reinforcement, forms, existing concrete and ground with which the concrete is to come into contact, shall be free from frost. Whenever the temperature of the surrounding air is below 5 deg. C all concrete placed in the forms shall have a temperature of between 15 deg. C and 32 deg. C and adequate means shall be provided for maintaining a temperature of not less than 10 deg. C for 10 days or for as much more as is necessary to ensure proper curing of the concrete. Under no circumstances may dry heat be used. Means shall be taken to humidify the air within the enclosure and to ensure that the moisture requirements for curing are maintained.

.8 Ensure Manufacturer's recommended curing conditions are maintained over the patch area when special patch Materials are used.

.9 In the event that the Contractor’s wet curing procedures are unacceptable, and any portion of the concrete becomes surface dry during the specified curing period, the Departmental Representative will have cause to reject the concrete.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00: Cast in Place Concrete.

.2 Section 05 50 00: Metal Fabrications.

.3 Section 09 91 00: Painting.

.4 Section 31 66 15: Helical Foundation Piles.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):
.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA S16:19, Limit States Design of Steel Structures.
.3 CSA S136-16, North American Specifications for the Design of Cold Formed Steel Structural Members.
.4 CSA S136S1:19, Supplement 1 to S136-16 North American Specifications for the Design of Cold Formed Steel Structural Members
.5 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
.6 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
.7 CSA W55.3-08 (R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
.8 CSA W59-18, Welded Steel Construction (Metal Arc Welding).
.9 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
.10 CSA W178.1-18, Certification of welding inspection organizations.
.11 CSA W178.2-14, Certification of welding inspectors.

.2 ASTM International Inc.:
.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot Dip Galvanized) coating on Iron and Steel Products.
.2 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
.3 ASTM F3125/F3125M-19e2, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPA) Minimum Tensile Strength, Inch and Metric dimensions.
.4 ASTM A500/A500M-20, Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
.5 ASTM A53/A53M-20, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless.
.6 ASTM A1011/A1011M-18a, Standard Specifications for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability and Ultra High Strength.
.7 ASTM A1085/A1085M-15, Standard Specification for Cold Formed

Welded Carbon Steel Hollow Structural Sections (HSS).
.8 ASTM A992/A992M-20, Standard Specifications for Structural Steel Shapes.
.9 ASTM F1554-18, Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength.
.10 ASTM A53/A53M-20 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):
.1 CISC Handbook of Steel Construction-Eleventh Edition 2016.
.2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
.3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.
.4 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).

.4 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:
.1 SSPC-SP 1, Solvent Cleaning.
.2 NACE No.3/SSPC-SP 6-2006-SG, Commercial Blast Cleaning.
.3 NACE No.4/SSPC-SP 7-2006-SG, Brush Off Blast Cleaning.
.4 NACE No.2/SSPC-SP 10-2006-SG, Near White Blast Cleaning.
.5 SSPC Technology Guide No.14 – Guide for the Repair of Imperfections in Galvanized, Organic or Inorganic Zinc-Coated Steel Using Organic Zinc Rich Coating.
.6 SSPC Paint Specification No. 20 – Zinc Rich Coating, Type I – Inorganic and Type II - Organic.

1.3 QUALITY ASSURANCE

.1 Qualifications
.1 Structural steel fabricator and erector to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3 for resistance welding of structural steel components, and to have CWB approved procedure for welding rebar (Grade 400W) to structural steel.
.2 Welders to be CWB approved, working under supervision of a CWB approved firm.
.3 Engage a Professional Engineer licensed in the place where the project is located to be responsible for design, detailing and installation of all connections related to structural steel work.

1.4 QUALITY CONTROL

.1 Submit in accordance with Section 01 45 00.

.2 Source Quality Control Submittals:
.1 Provide all submittals 4 weeks prior to starting fabrication of structural steel.
.2 Mill test reports:
.1 Provide upon request from Departmental Representative mill test reports to include ladle analysis and physical test

results, and to show chemical and physical properties and other details of steel to be incorporated in project.
.2 The reports to be correlated to the materials or products to which they pertain.

.3 Tolerances
.1 Conform to the fabrication and erection tolerances of CSA S16.
.2 Comply with more stringent tolerances if specified elsewhere to suit interfacing materials or AESS members.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Shop Drawings:
.1 Provide drawings stamped and signed by the Professional Engineer responsible for steel connections.
.2 If additional information is required from Departmental Representative, allow a minimum of five working days for Departmental Representative to review and respond to the request for information.
.3 It is advisable to submit erection diagrams for review before preparing shop details. Copies of plans and section details developed by Departmental Representative will not be accepted as erection diagrams.

.3 Erection drawings:
.1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
.1 Description of erection methods.
.2 Sequence of erection.
.3 Temporary bracings.
.4 Beam sizes (in addition to beam marks).
.5 Connections where threads must be excluded from shear plane.
.6 Details of all field welded connections
.2 Provide setting drawings showing dimensions and details for placing steel assemblies which are set in concrete.

.4 Fabrication drawings:
.1 Submit fabrication drawings showing designed assemblies, member sizes, components and connections. Show on drawings:
.1 Material specifications.
.2 Surface preparation.
.3 Shop painting / galvanizing.
.4 Section splices.
.5 Types of shop and field connections.
.6 Net weld lengths.
.7 Precautions which will be taken to exclude threads from shear planes of bearing type bolted connections (where applicable).
.8 Vent holes required for galvanizing process.
.9 Architectural clearance lines and finishes where connections could encroach other works.
.2 Show details by which steel assemblies, which are set in

concrete, are to be connected to the formwork.
.3 Substitution of alternative sections will only be allowed provided the new members have equal or greater capacity and stiffness and their dimensions are approved by Departmental Representative.

.5 When requested, submit sketches and design calculations stamped and signed by the Professional Engineer responsible for connection design.

.6 On completion of erection, submit a letter signed and sealed by the Professional Engineer responsible for structural steel connections certifying that the work has been completed in accordance with all contract documents.

PART 2 - PRODUCTS

2.1 DESIGN AND DETAILING REQUIREMENTS

.1 Design details and connections in accordance with requirements of CSA S16, CSA S136, and CSA S136S1 to resist forces and to allow for movements indicated. Consider load effects due to fabrication, erection and handling. Connect beams for the forces shown; if no force is indicated, connect non-composite beams for the reaction due to maximum uniformly distributed load capacity of the beam in bending

.2 Connection design to include consideration of all pass-through forces, including tension, compression, moment and shear. Provide local reinforcement at connection or joint as required.

.3 Follow conceptual connection details if shown on structural drawings. Do not change without Departmental Representative written approval. If welds are defined on drawings, the sizes shown are minimum requirements which might need to be increased to suit connection design.

.4 Assume that bolt threads are intercepted by shear plane, unless special measures are indicated on shop drawings to exclude threads from shear plane.

.5 Beams:
.1 Select beam end connections from CISC "Handbook of Steel Construction" when connection for shear only (standard connection) is required.
.2 Typical beam to spandrel beam and beam to column connections to be two sided or end plate connections.
.3 Select or design beam end connections for factored shear indicated on plans.
.4 When shears are not indicated, select or design non-composite beam end connections to resist reaction due to maximum uniformly distributed load capacity of the beam in bending.
.5 Where axial forces occur in beams framing to opposite sides of a supporting member, design connections for a pass-through force equal to the smaller axial force. If beam sizes differ, assume the axial force is centred in the smaller beam.
.6 Where axial forces occur in beams framing into columns, connect

beams at both sides of columns for the axial force shown.
.7 Where no axial force is shown for beam to column connection, design to resist horizontal tension / compression equivalent to 2% of the factored axial force in column, in addition to all other loads.
.8 Seated beam connections to have top clip angles.
.9 End bearing connections of inclined members to have horizontal bearing plane at supported member.
.10 Extend beams bearing on walls for the full length of bearing plates.
.11 For beams continuous over supports and for beams supporting columns, provide min. 6 mm (1/4") stiffener plates at each side of web at point of concentrated load, unless thicker stiffeners are required by connection design or different details are shown on drawings.
.12 Provide all spandrel beams and all floor beams not fully braced by floor construction with top and bottom flange connections for torsional restraint.

.6 Columns:
.1 In addition to all other loads, connect columns to base plates to transfer horizontal load equal to 2% of the column vertical load.
.2 In addition to all other loads, connect columns to base plates to transfer tensile load equal to the capacity of all anchor bolts,
.3 Provide seat angles for joist support at sides of columns continuous through floor.
.4 Provide connection for tie joist bottom chord at all columns supporting joists; coordinate with joist supplier.
.5 Unless otherwise noted on drawings, provide 102 x 102 x 9.5 seat angles attached to sides of columns to support masonry lintels adjacent to columns. Length of seat to equal width of lintel minus 25 mm (1").
.6 Provide connection for masonry wall steel lintels adjacent to columns.
.7 Provide diagonal or cantilevered angles at sides of columns where required to support deck or slab.
.8 Provide cap plates at tops of columns where required for support of deck, slab, joists, beams or roof anchors.

.7 Moment connections:
.1 Provide moment connections at splices to maintain continuity of cranked beams. Provide header plates or stiffener plates to resist unbalanced flange forces at splices.
.2 Where moment connections are called for but values are not indicated, design for moment capacity of the smaller member in the connection.
.3 Install web and flange stiffener plates at moment connections as required by connection design and detail but in every case when indicated on the drawings. If the shear generated in column web exceeds its shear capacity, reinforce the web.

.8 Holes:
.1 Where holes for services are required through webs of beams or columns, coordinate size and location with Architectural, Mechanical and Electrical drawings, and show on fabrication drawings. Reinforce in accordance with Typical Detail. Alternatively, design reinforcing in

accordance with the procedure set forth in the CISC Handbook of Steel Construction and provide calculations for Departmental Representative's review.
.2 Provide holes in beam flanges or weld threaded studs as required for attachment of wood nailers.
.3 Provide 16 mm (5/8") diameter weep holes in base plates of HSS columns which are not made watertight.
.4 Provide vent holes in HSS sections where required for galvanizing process. Locate so that any water inside HSS will drain away when HSS is in its final position. Maximum size – 16 mm (5/8") diameter. Fill holes with vent hole plugs after galvanizing.
.5 Provide 19 mm (3/4") dia. vent holes at centerline of all cast in plates supporting columns.

.9 Provide slotted holes long enough to allow for deflection indicated on drawings plus construction tolerance, assuming bolts are centred in slots. Bolts are to be finger-tight with burred threads to allow for movement during the life of structure without bolts loosening.

.10 Do not oversize anchor rod holes for site tolerances. Use hole sizes suggested in the CISC Handbook of Steel Construction.

.11 Provide closure plates for all exposed and for all exterior tubular members.

2.2 MATERIALS

.1 Structural steel: to CSA G40.20/G40.21, with the following Grades:
.1 W, WWF and S sections, channels and angles: 350W, or ASTM A992/A992M, Grade 50(345MPa).
.2 Plates, bars:300W.
.3 Hollow Structural Sections: 350W (Class 'C" OR "H') or ASTM A500/A500M (Grade 'C').
.4 Pipe: ASTM A53/A53M, 240W.

.2 Anchor rods: 300W to CSA G40.20/G40.21, or ASTM F1554.

.3 Bolts, nuts and washers: to ASTM F3125/F3125M, grade A325M.

.4 Weldable reinforcing steel: to CSA G30.18, deformed bars.

.5 Welding materials: to CSA W48 and CSA W59, certified by Canadian Welding Bureau. For members in seismic force resisting system, refer to additional brittleness requirements in CSA S16.

.6 Shop paint: to CISC/CPMA 1.

.7 Shop paint primer: to CISC/CPMA 2, solvent reducible alkyd, red oxide, compatible with specified topcoat.

.8 Zinc-rich coating: to SSPC Paint Specification No.20, compatible with top coat (where specified).

.9 Hot dip galvanizing: to ASTM A123/A123M, minimum zinc coating of 600

g/m².

.10 Epoxy coating: pre-mixed, 2 components, high-solids (volume of solids 87 ±3%), self-priming,

.11 Galvanizing vent hole plug: Grade 6061 Aluminum circular plug.

2.3 FABRICATION

.1 Fabricate structural steel in accordance with CSA S16 and with reviewed shop drawings.

.2 Continuously seal hollow members exposed to weather by intermittent welds and plastic filler unless continuous welds are indicated on drawings.

.3 Position beams having permissible mill camber so that the camber is up.

.4 HSS members which require galvanizing to either be per CSA G40.20/G40.21, grade 350W, Class H, or to be stress relieved prior to galvanizing.

.5 Mill column bearing plates as required to provide full contact bearing and develop column bearing strength.

.6 Complete welded shop connections prior to galvanizing.

.7 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left unpainted, place marking at locations not visible from exterior.

.8 Match marking: shop mark bearing assemblies and splices for fit and match.

2.4 SHOP PAINTING

.1 Clean all members to SSPC-SP 1 – Solvent Cleaning, remove loose mill scale, rust, oil, dirt and foreign matter using any suitable method.

.2 In addition, for members receiving shop primer paint: Clean steel to SSPC-SP 7 Brush-Off Blast Cleaning.

.3 In addition, for members receiving intumescent coating: Clean steel to SSPC-SP 6 Commercial Blast Cleaning

.4 In addition, for members receiving zinc-rich coating: Clean steel to SSPC-SP 10 Near White Blast Cleaning.

.5 Apply one coat of shop paint CISC/CPMA 1 to steelwork in the shop with the exception of:
.1 Members to receive spray fireproofing.
.2 Members to receive a finish coat of paint on site for which a CISC/CPMA 2 shop primer is required.
.3 Members to receive intumescent coating for which a compatible

shop primer is required.
.4 Members to receive zinc-rich coating.
.5 Galvanized members.
.6 Surfaces encased in or in contact with cast-in-place concrete including top flanges of beams supporting slabs.
.7 Surfaces and edges to be field welded for a distance of 50 mm (2") from joints.

.6 Apply one coat of compatible primer paint (CISC/CPMA 2-75) in the shop to steelwork to receive a finish coat of paint on site.

.7 Apply galvanizing in the shop to all structural steel located beyond the vapour barrier, including:
.1 Shelf angles and hangers in exterior walls.
.2 Lintels in exterior walls.
.3 Exposed exterior steel members.
.4 Exposed anchor rods.
.5 Other steel noted on drawings.

.8 If galvanized steel is to be painted, use only non passivated galvanizing process (without chromate coating).

.9 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5°C.

.10 Maintain dry condition and 5°C minimum temperature until paint is thoroughly dry.

.11 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 - EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CSA S16.

.2 Welding: in accordance with CSA W59.

3.2 ERECTION

.1 Erect structural steel in accordance with CSA S16 and reviewed erection drawings.

.2 Do not field cut or alter any members without Departmental Representative approval.

.3 Make adequate provision for all loads acting on the structure during erection. Provide erection bracing to keep the structure stable, plumb and in true alignment during construction. Bracing members or connections shown on Structural Drawings are those required for the completed structure, and may not be sufficient for erection purposes. For load bearing masonry construction, maintain bracing until completion of masonry work and floor / roof decks which together provide permanent

bracing. Do not remove erection bracings without written approval from the Engineer who designed it.

.4 Steel framing to be plumb at temperature of 20°C. If erection is carried out at temperatures greatly differing from 20°C, make adequate provisions; some members may need to be +erected out of plumb in order to become plumb when the temperature stabilizes at 20°C.

.5 Set column base plates to the elevation required for grouting using steel shims or leveling screws attached to sides of base plates. Do not fasten leveling nuts to anchor rods. Alternatively, for base plates equal or smaller than 350 mm x 350 mm (14” x 14”), leveling plates set with grout and level to within 1.5 mm (1/16") across the plate can be used. Do not erect columns upon plates exceeding this tolerance. Lift base plates for inspection when directed.

.6 Grout under column base plates and beam bearing plates as soon as steelwork is completed with 40 MPa Grout. Do not add load on steelwork until grouting is completed and grout strength has reached at least 20 MPa.

.7 Do not make permanent connections until structure has been properly aligned.

.8 Install bolts which are not pre-tensioned to be snug tight.

.9 Where slotted connections are shown on structural drawings, finger tighten bolts to a snug fit and burr threads to prevent nuts from working loose.

.10 Apply dry lubricant to threads of all galvanized bolts prior to installation.

.11 Weld beams to bearing plates unless otherwise noted on drawings.

.12 Adjust and finalize connections at wall supporting elements affected by floor beam deflections after concrete is poured.

.13 Provide dissimilar metal separators at connections between aluminum members and structural steel.

.14 Report ill-fitting connections to Departmental Representative before taking corrective measures.

.15 Distribute hanger loads from mechanical and heavy electrical services suspended from steelwork uniformly along members. Alternate hanger position on either side of members.

.16 When welding after galvanizing is in place, grind away galvanizing at areas to be welded.

.17 Do not weld in an ambient temperature below -17°C. Preheat material adjacent to welding areas when ambient temperature is between -17°C and +4°C.

.18 Remove slag from all completed welds so that they may be visually inspected.

.19 Seal members by continuous welds where indicated.

.20 Remove field connection aids from all surfaces which will be exposed to view and where interfering with clearances required by other trades.

.21 Connect hangers for mechanical and electrical services and other non-structural elements not to cause twisting of steel members or excessive bending of member flanges.

.22 Do not apply lateral loads to members unless approved by the departmental representative.

3.3 FIELD PAINTING

.1 Touch up damaged surfaces with the same paint as the shop coat.

.2 Repair any galvanized or zinc rich painted surfaces which have been damaged or field welded in accordance with SSPC Technology Guide No.14.

.3 Clean and prepare surfaces of bolts, which will receive a finished coat of paint in the same manner as the connected steelwork.

.4 Clean non galvanized steel surfaces which will be in contact with ground to SSPC SP-3 (Power Tool Cleaning) and apply two coats of epoxy paint to achieve dry film thickness between 0.20 mm and 0.35 mm (8 mils and 14 mils).

3.4 INSPECTION AND TESTING

.1 An Inspection and Testing Agency (certified to CSA W178.2) will be appointed to carry inspection and testing of all structural steel.

.2 Do not commence fabrication until details of inspection have been worked out with the Agency.

.3 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required.

.4 The Inspection Agency will submit reports to Departmental Representative, Contractor and Municipal Authorities covering the Work inspected and provide details of errors or deficiencies observed.

.5 Work will be inspected in shop and when erected. Store fabricated members in shop so that they are accessible for inspection.

.6 Provide Inspection and Testing Agency with a copy of reviewed shop drawings.

.7 Welding inspection:
- .1 Welding inspection will be conducted in field.
- .2 The Inspector will check welders' CWB certification.

.3 The Inspector will review welding procedures for conformance with CWB requirements, manufacturers' requirements and standard practice.
.4 The inspector will visually check all welds in moment connections, all welds of roof anchors to the base structure, 60% of welds in hanger connections and 20% of all other welds for:
.1 Size, length and profile
.2 Joint preparation, including cleaning and removal of any paint.
.3 Fit up and alignment.
.4 Penetration and fusion.
.5 Slag removal.
.6 Distortion.
.7 Porosity.
.8 Cracks.

.8 Field inspection:
.1 Arrange for the Inspector to start field inspection as soon as each section of the Work is completed, plumbed, bolts tightened and field welding finished.
.2 The Inspector will sample erection procedures for general conformity with Contract requirements.
.3 The Inspector will check general fit-up and tolerances and report any apparent distortions and misalignments.
.4 Minimum 10% of columns and 10% of beams will be checked by instruments for plumbness, alignment and elevation.
.5 Field inspection will include:
.1 Checking individual frame members for twisting, sweep and local damage.
.2 Checking levelness of leveling plates.
.3 Inspection of grouting under base plates and bearing plates.
.4 Checking column bearings on cast in plates.
.5 Checking bearings on steel and masonry.
.6 Inspection of bolting and post installed anchors as described below.
.7 Checking that column connections are adjusted to keep the columns plumb after supported structure has deflected due to dead loads applied to floor and roof deck.
.8 Inspection of field painting.
.9 Inspection of field touch-up.
.6 Bolting inspection:
.1 The Inspector will visually check all bolts in bearing connections. Where erection drawings indicate bolts with threads excluded from the shear plane, he will remove nuts from 1% of all bearing bolts and check that thread is excluded from the shear planes.

PART 1- GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00: Cast in Place Concrete.

.2 Section 05 12 23: Structural Steel for Buildings.

.3 Section 05 31 00: Steel Decking.

.4 Section 05 50 00: Metal Fabrications.

.5 Section 07 84 00: Fire Stopping.

.6 Section 09 91 00: Painting.

.7 Section 13 34 23: Prefabricated Buildings.

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA):
.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA S16:19, Limit States Design of Steel Structures.
.3 CSA S136-16, North American Specifications for the Design of Cold Formed Steel Structural Members.
.4 CSA S136S1:19, Supplement 1 to S136-16 North American Specifications for the Design of Cold Formed Steel Structural Members
.5 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
.6 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
.7 CSA W55.3-08 (R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
.8 CSA W59-18, Welded Steel Construction (Metal Arc Welding).
.9 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.2 ASTM International Inc.:
.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot Dip Galvanized) coating on Iron and Steel Products.
.2 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
.3 ASTM F3125/F3125M-19e2, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPA) Minimum Tensile Strength, Inch and Metric dimensions.
.4 ASTM A1011/A1011M-18a, Standard Specifications for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability and Ultra High Strength.

.5 ASTM F1554-18, Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength.

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):
.1 CISC Handbook of Steel Construction.
.2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
.3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.
.4 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).

.4 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:
.1 SSPC-SP 1, Solvent Cleaning.
.2 NACE No.3/SSPC-SP 6-2006-SG, Commercial Blast Cleaning.
.3 NACE No.4/SSPC-SP 7-2006-SG, Brush Off Blast Cleaning.
.4 NACE No.2/SSPC-SP 10-2006-SG, Near White Blast Cleaning.
.5 Quality SSPC Paint System Guide No.14 – Guide for Repair of Imperfections in Galvanized or Inorganic Zinc Coated Steel Using Organic Zinc Rich Coating.
.6 SSPC Technology Guide No.14 – Guide for the Repair of Imperfections in Galvanized, Organic or Inorganic Zinc-Coated Steel Using Organic Zinc Rich Coating.
.7 SSPC Paint Specification No. 20 – Zinc Rich Coating, Type I – Inorganic and Type II - Organic.

1.3 QUALITY ASSURANCE

.1 Qualifications:
.1 Steel joist fabricator and erector to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3, Division 1 or 2 for resistance welding of structural steel components and to have CWB approved procedure for welding rebar (Grade 400W) to structural steel in accordance with CSA W186 (if applicable).
.2 Welders to be appropriately qualified, working under direction of a qualified welding supervisor.
.3 Engage a Professional Engineer licensed in the place where the project is located to be responsible for design, detailing and installation of all steel joists.

1.4 QUALITY CONTROL

.1 Submit in accordance with Section 01 45 00.

.2 Source Quality Control Submittals:
.1 Submit mill test reports 4 weeks prior to fabrication of steel joists.
.1 Mill test reports to show chemical and physical properties and other details of steel to be used for steel joists.

.2 The reports to be correlated to the materials or products to which they pertain.

.3 Tolerances

.1 Conform to the fabrication and erection tolerances of CSA S16.

.2 Comply with more stringent tolerances if specified elsewhere to suit interfacing materials or AESS members.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Provide drawings stamped and signed by the Professional Engineer responsible for steel joist design.

.2 Submit a copy of that Engineer's Certificate of Authorization, and proof of his liability insurance.

.3 Show on drawings:

.1 Material specifications.

.2 Joist geometry.

.3 Joist spacing.

.4 Joist camber.

.5 Member sizes.

.6 Joint details.

.7 Net weld lengths.

.8 Section splices.

.9 Bearing and anchorage details.

.10 Surface preparation.

.11 Shop painting / galvanizing.

.12 Bridging, including anchorage details at ends of bridging lines.

.13 Joists which are considered AESS, and their category; Refer to AESS Category Matrix as shown in Table 1 of the CISC Code of Standard Practice, Appendix I.

.14 Temporary bracings.

.4 On completion of erection, submit a letter signed and sealed by the Professional Engineer responsible for steel joists certifying that the work has been completed in accordance with all contract documents.

PART 2- PRODUCTS

2.1 DESIGN AND DETAILING REQUIREMENTS

.1 Design joists in accordance with requirements of CSA S16, CSA S136, and CSA S136S1. Consider load effects due to fabrication, erection and handling.

.2 Submit calculations for strength and deflection. Show design loads, member forces and utilizations.

.3 Arrange joists and bridging to accommodate recessed fixtures and

ductwork. Refer to Mechanical and Electrical Drawings.

.4 Arrange members to form a statically determinate truss. Chose web and chord members to have an axis of symmetry in the plane of the web. Line up web members along joist runs sufficiently to permit mechanical services.

.5 Minimum thickness of material: flats and hot rolled sections 2.5 mm (0.10"); rods 10 mm (0.39") diameter; cold formed sections 2mm (0.079"); members supporting steel deck 3.15 mm (0.125").

.6 Where joists support 76 mm (3”) deep composite steel deck, total width of top chord elements that actually support the deck to be 140 mm (5-5/8”) minimum.

.7 Design joists to carry loads indicated on Structural Drawings, including uplifts, point loads and axial loads; see Steel Joists General Notes for additional design loads. The loads shown on drawings are working loads unless otherwise noted.

.8 Unless otherwise noted, total load deflection not to exceed 1/240th of the span and live load deflection not to exceed 1/360th of the span.

.9 Unless otherwise shown on drawings, if a joist is adjacent to a wall or a column which provide next line of support to the deck carried by the joist and are located within the middle half of the joist span, stiffen the joist so that the total load deflection does not exceed d/50, where “d” is the distance between the joist and the adjacent wall/column. In addition, design subsequent joints so that differential total load deflection between any two adjacent joints does not exceed joist spacing / 50. Maximum camber for these joists not to exceed total load deflection.

.10 Design joists and bridging to meet requirements of any Fire Rated Assembly Design specified for the Project. Increase capacity as required for load restricted ULC / UL assemblies.

.11 Apply unbalanced live loads and concentrated loads in accordance with CSA S16.

.12 Design joist chords for additional axial forces noted on plan or from horizontal bracings connected to them. Connect joists to all supporting members by welding or bolting.

.13 Centre reaction point of joist framing from one side only over centroid of supporting beam. Where necessary, increase shoe depths as required for the first diagonal to clear the supporting structure. Coordinate the required supporting steel elevation with steel trade.

.14 Make all joist shoes with solid webs.

.15 Design joist shoe connections to supporting members to be able to resist uplift and to transfer axial force into joist top chord equal to 10% of

the joist reaction (but not less than 25 kN).

.16 Design joist shoes for rollover forces where shown on structural drawings.

.17 At columns where floor slab does not exist at the column side opposite to the joist connection point (such as at perimeter columns), design joist shoe connection to resist axial force not less than 2% of the column axial load at that level.

.18 Provide top and bottom chord extensions where required. Provide tie joists at all columns as required for erection stability.

.19 Where supporting girders run over tops of steel columns, design and connect tie joist bottom chord for axial load of +/- 25 kN (in addition to the primary chord loads).

.20 Where bearing plate sizes are not noted on drawings, design bearing plates for a maximum factored bearing pressure of 1.9 MPa on masonry and 11.0 MPa on cast in place concrete.

.21 Unless noted otherwise, camber floor joists for dead load deflection, excluding any partition allowance.

.22 Unless noted otherwise, camber roof joists in accordance to CSA S16.

.23 Provide holes to receive 16 mm (0.625") bolts for securing of any wood framing and blocking. Space at 600 mm (2'-0") centres. Substitute 16 mm (0.625") threaded studs with nuts in locations where appearance is a factor.

2.2 MATERIALS

.1 Steel joists: to CSA S16, CSA S136, and CSA S136S1.

.2 Structural steel: to CSA G40.20/G40.21.

.3 Welding materials: to CSA W48 and CSA W59, certified by Canadian Welding Bureau.

.4 Bolts, nuts and washers: to ASTM F3125/F3125M, Grade A325.

.5 Anchor rods: CSA G40.21/G40.21 or ASTM F1554, refer to drawings.

.6 Shop paint: to CISC/CPMA 1.

.7 Shop paint primer: to CISC/CPMA 2, solvent reducible alkyd, red oxide, compatible with specified topcoat.

.8 Zinc-rich coating: to SSPC Paint Specification No.20, compatible with top coat (where specified).

.9 Hot dip galvanizing: to ASTM A123/A123M, minimum zinc coating of 600

g/m².

.10 Headed studs: to CSA W59, Type B, Fy=350 MPa.

.11 Joint filler for exposed steelwork: Epoxy resin.

2.3 FABRICATION

.1 Fabricate steel joists in accordance with CSA S16, CSA S136, CSA S136S1, and with reviewed shop drawings.

.2 Weld in accordance with CSA W59 and CSA W186.

.3 Stagger chord member splices. Do not ship joists to the site before being inspected.

2.4 SHOP PAINTING

.1 Clean all joists to SSPC-SP 1. Remove loose mill scale, rust, oil, dirt and foreign matter.

.2 In addition, for members receiving zinc-rich coating: Clean steel to SSPC-SP 10 Near White Blast Cleaning.

.3 Apply one coat of shop paint CISC/CPMA 1 to joists in the shop except for:
.1 Members to receive spray fireproofing.
.2 Members to receive a finish coat of paint on site for which a CISC/CPMA 2 shop primer is required.
.3 Members to receive zinc-rich coating.
.4 Galvanized members.
.5 Top chords of composite joists with field welded shear connectors.
.6 Surfaces encased in or in contact with cast-in-place concrete including top chords of joists supporting slabs.
.7 Surfaces and edges to be field welded for a distance of 50 mm (2") from joints.

.4 Apply galvanizing in the shop to:
.1 Exposed exterior canopy steel noted on drawings.

.5 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.6 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.7 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3- EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CSA S16.

.2 Welding: in accordance with CSA W59 and CSA W186

3.2 EXAMINATION

.1 Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for steel joist framing installation:
.1 Visually inspect substrate.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied.

3.3 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work. Report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

.2 Take precautions to protect existing works from damage. Repair damage to adjacent materials caused by steel joist installation.

3.4 ERECTION

.1 Erect steel joists in accordance with CSA S16 and reviewed shop drawings.

.2 Do not field cut or alter any members without the Departmental Representative approval.

.3 Make adequate provision for all loads acting on the structure during erection. Provide erection bracing to keep the structure stable, plumb and in true alignment during construction. Complete installation of bridging and anchorages before placing construction loads on joists. For load bearing masonry construction, maintain bracing until completion of masonry work and floor / roof decks which together provide permanent bracing. Do not remove erection bracings without written approval from the Engineer who designed it.

.4 Where bottom cord bridging is terminated by connection to steel beam, bring it up and connect to beam top flange.

.5 Do not make permanent connections until structure has been properly aligned.

.6 Report ill-fitting connections to the Departmental Representative before taking corrective measures.

.7 When welding after galvanizing is in place, grind away galvanizing at areas to be welded.

.8 Do not weld in an ambient temperature below -18°C. Preheat material adjacent to welding areas when ambient temperature is between -18°C and 0°C.

.9 Protect installed products from damage during construction.

.10 AESS joists: erect using softened slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning.

3.5 FIELD PAINTING

.1 Paint in accordance with Section 09 91 00 Painting

.2 Touch up damaged surfaces with the same paint as the shop primer.

.3 Repair any galvanized or zinc rich painted surfaces which have been damaged or field welded in accordance with SSPC Technology Guide No.14.

3.6 INSPECTION AND TESTING

.1 An Inspection and Testing Agency (certified to CSA W178.1 & CSA W178.2) will be appointed to carry inspection and testing of all steel joists.

.2 Refer to Section 05 12 23 for inspection and testing requirements.

PART 1- GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00: Concrete Reinforcing.

.2 Section 03 30 00: Cast in Place Concrete.

.3 Section 05 12 23: Structural Steel for Buildings.

.4 Section 05 21 00: Steel Joists.

.5 Section 05 50 00: Metal Fabrications.

.6 Section 09 91 00: Painting.

.7 Section 13 34 23: Prefabricated Buildings.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):
.1 CSA S136-16, North American Specifications for the Design of Cold Formed Steel Structural Members.
.2 CSA S136S1:19, Supplement 1 to S136-16 North American Specifications for the Design of Cold Formed Steel Structural Members
.3 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
.4 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
.5 CSA W55.3-08 (R2018), Certification of Companies for Resistance
.6 CSA W59-18, Welded Steel Construction, (Metal Arc Welding).

.2 ASTM International Inc.:
.1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.3 Canadian Sheet Steel Building Institute (CSSBI):
.1 CSSBI 10M-18, Standard for Steel Roof Deck.
.2 CSSBI 12M-18, Standard for Composite Steel Deck.

1.3 QUALITY ASSURANCE

.1 Qualifications
.1 Deck supplier and erector to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.
.2 Welders to be CWB approved for deck welding.
.3 Engage a Professional Engineer licensed in the place where the project is located to be responsible for design, detailing and installation of all decking.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's data sheets for each deck type.
.2 Submit product data confirming capacity of mechanical fasteners to resist uplift.
.3 When requested, provide data to substantiate deck load capacity, including diaphragm shear capacity.

.3 Shop Drawings:
.1 Provide drawings stamped and signed by a Professional Engineer responsible for design of steel decking. Drawings to include diaphragm connection design.
.2 Submit a copy of the Engineer’s Certificate of Authorization, and proof of liability insurance
.3 Show on drawings:
.4 Deck layout.
.5 Deck profile and base steel thickness.
.6 Type of deck metallic coating. Indicate deck which is to be painted on site.
.7 Gravity and uplift loads, diaphragm shear and deflection requirements the deck is designed for.
.8 Type and spacing of connections to supports and between sheets.
.9 Projections and openings.
.10 Reinforcement details and accessories.
.11 Layout, size, type and welding requirements for welded stud shear connectors.

PART 2- PRODUCTS

2.1 DESIGN AND DETAILING REQUIREMENTS

.1 Design loads, deck depths and core nominal thicknesses are shown on Structural Drawings. Chose deck profile, design connections and detail in accordance with CSA S136, CSA S136S1, CSSBI 10M and CSSBI 12M and to satisfy requirements of any Fire Rated Assembly Design specified for the Project.

.2 If increased wind uplift loads applicable at roof edges and corners are not specifically noted on Structural Drawings, increase the minimum design wind uplift shown (which is applicable in the zones away from roof edges) in accordance with the User’s Guide to NBC – Structural Commentaries (Part 4 of Division B).

.3 Unless otherwise noted on drawings, floor deck to carry weight of wet concrete and appropriate construction load allowance without shoring.

.4 Deflection limitations for roof deck:
.1 1/360 of span under specified live load.
.2 1/240 of span under total load.

.5 Make deck sheets continuous over 3 spans wherever possible. Combine triple span and double span sheets to suite multi span deck layouts. Use single span sheets only where single span condition is shown on drawings.

.6 Design reinforcement for roof deck openings up to 450 mm (18”) wide across flutes.

2.2 MATERIALS

.1 Steel Deck: Zinc-iron Alloy (ZF) coated steel sheet to ASTM A653/A653M, structural quality Grade 230, with ZF75 coating, or aluminum-zinc alloy (AZ) coated steel sheet to ASTM A792/A792M, structural quality grade 230 with AZ 150 coating.

.2 Galvanized deck: Zinc (Z) coated steel sheet to ASTM A653/A653M, structural quality Grade 230, with Z275 coating or aluminum-zinc alloy (AZ) coated steel sheet to ASTM A792/A792M, structural quality grade 230 with AZ 150 coating.

.3 Acoustic deck: with web perforations reducing capacity of the deck without perforation by maximum 5%.

.4 Fasteners for galvanized deck and prefinished deck: stainless steel, hex head, self-tapping screws with EPDM bonded washers.

.5 Powder-actuated fasteners: Hilti Decking Fastening System.

.6 Cover plates, closures, pour stops, edge strips, flashings and deck reinforcing: steel sheet with minimum base steel thickness of 0.91 mm. Metallic coating same as deck material.

2.3 TYPES OF DECKING

.1 Roof deck: with interlocking or overlapping side joints. Centre to centre rib spacing to be:
.1 150 mm (6") for 38 mm (1.5") deep deck
.2 150 mm (6") or 200 mm (8") for 76 mm (3") deep deck.

.2 Where roof deck fasteners and fastening pattern are specified on drawings, use deck with flute spacing and side lap type which can accommodate the specified fasteners.

.3 Use only decks with overlapping side joints where side lap connections need to be screwed or where multiple deck layers are specified.

2.4 FABRICATION

.1 Conform to CSA S136, CSA S136S1, and CSA W59.

.2 Fabricate sections from steel sheets by rolling. Form integral ribs which will bear on supports and form interlocking male and female side laps.

PART 3- EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CSA S136, CSA S136S1, CSSBI 10M and CSSBI 12M.

.2 Welding: in accordance with CSA W59, except where specified otherwise.

3.2 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates previously installed under other Sections or Contracts are acceptable for steel decking installation.
.1 Visually inspect substrate.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied.

3.3 ERECTION

.1 Erect steel deck in accordance with CSA S136, CSA S136S1, CSSBI 10M, CSSBI 12M, and reviewed shop drawings.

.2 Do not overload structure during erection. Place deck bundles near columns.

.3 Align deck end to end for accurate fit with corresponding sections. Sections to be parallel, even and straight.

.4 Locate deck rib directly over perimeter steel beams spanning parallel to deck and at same elevation as underside of deck.

.5 Lap over supports. Minimum lap 50 mm (2"), maximum lap 100 mm (4").

.6 For exposed deck end laps, do not extend lower deck sheet past the face of the supports.

.7 Exercise particular care in erection of exposed deck. Sections which are dented, damaged or perforated by welding will be rejected.

.8 Connections
.1 Use connections specified on reviewed shop drawings, to suite the required corrosion protection, uplift, diaphragm shear, requirements of any Fire Rated Assembly Design.
.2 Connect deck to all supporting beams and perimeter beams. Interconnect sheets at side laps.
.3 Predrill holes for screws connecting deck to timber beams. Screws shall tap metal and extend into wood, clamping deck to wood.
.4 Fasten stud shear connectors to composite beams by welding to beams (through deck where necessary) with a full 360 degrees weld capable of developing 120% of the shear values listed in CSA S16. Fastening procedure to conform to the recommendations of the stud

manufacturer. Test the first two studs installed each day in accordance with CSA W59. Maintain record of the studs tested. Replace studs rejected by Inspection and Testing Agency.

.9 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

.10 Closures and Accessories
.1 Provide all required edge stiffeners, closures, reinforcing sheet steel and flashing.
.2 Reinforce edge of free spanning deck with channel shaped edge strip.
.3 Provide flashing at columns and points of discontinuity to prevent leakage when concrete is placed over deck.

.11 Openings
.1 Structural Drawings do not show all openings required. Refer also to Architectural, Mechanical and Electrical drawings.
.2 Cut all opening required by other trades.
.3 Reinforce roof deck openings up to 450 mm (18”) across flutes. Maximum size of unreinforced openings not to exceed 150 mm (6”)

.12 Protect existing works. Repair damage to adjacent materials caused by steel decking installation.

.13 Protect installed products and components from damage during construction.

.14 Temporary shoring, if required, not to be removed until concrete attains 75% of its specified 28 day compression strength.

3.4 INSPECTION AND TESTING

.1 An Inspection and Testing Agency (certified to CSA W178.1 & CSA W178.2) will be appointed to carry out inspection and testing of steel decks and check conformance with Contract documents and reviewed shop drawings.

.2 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required.

.3 The Inspection Agency will submit reports to Departmental Representative, Contractor and Municipal Authorities covering the Work inspected and provide details of errors or deficiencies observed.

.4 Work will be inspected when erected.

.5 Inspection will include:
.1 Checking that mill test reports are properly correlated to materials.
.2 Confirming that all materials meet specifications.
.3 Checking welders' CWB certification.
.4 Checking deck types, gauge and coating thicknesses.
.5 Checking all welding, fastening, side laps and button punching.

.6 Checking deck reinforcement at holes cut in deck.
.7 Checking installation of sheet metal strips and edge reinforcing.
.8 Checking deck bearing lengths at supporting members.
.9 Checking appearance of exposed steel deck.
.10 Checking and testing field welded stud shear connectors as follows:

.1 The Inspector will visually check all stud shear connectors on composite steel beams.

.2 At least one stud in every 150 and all studs which do not have a complete end weld, which are repaired by welding or which show less than the normal reduction in height due to welding will be bent 15 degrees from their axis towards the nearest support, as specified in CSA W59.

.3 Bent studs that show no sign of failure will be accepted and shall remain in the bent position. Studs that crack in weld, base metal or shank will be rejected.

.4 Studs with end welds covering less than 85% of the perimeter will be rejected even if they pass the bend test.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)
.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.3 CSA International (CSA)
.1 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
.2 CSA W55.3-08(R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
.3 CSA W59-18, Welded Steel Construction (Metal Arc Welding).
.4 CSA S136-16 Package, North American Specification for the Design of Cold Formed Steel Structural Members including CSA S136S1:19 Supplement 1.

.4 Canadian Sheet Steel Building Institute (CSSBI)
.1 CSSBI 50M-06, Lightweight Steel Framing Manual.
.2 CSSBI Fact Sheet #3 February 2006, Care and Maintenance of Prefinished Sheet Steel Building Products.
.3 CSSBI Technical Bulletin Vol. 7, No. 2, September 2011, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.
.4 CSSBI S5-11, Guide Specification for Wind Bearing Steel Studs.

.5 Master Painters Institute (MPI)
.1 Architectural Painting Specification Manual - 2019.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for structural metal studs and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate design loads, member sizes, Materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
.3 Indicate locations, dimensions, openings and requirements of related Work.

.4 Indicate welds by welding symbols as defined in CSA W59.

.4 Samples:
.1 Submit samples of framing components for review.
.2 Submit duplicate 300 x 300 mm samples of each type.

1.3 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: submit product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.3 Manufacturer Reports: Submit manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect structural metal studs from nicks, scratches, and blemishes.
.3 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.
.4 Handle and protect galvanized Materials from damage to zinc coating.
.5 Replace defective or damaged Materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Steel: to CSA S136 and CSA S136S1, fabricated from ASTM A653/A653M, Grade A to D steel, minimum 30% recycled content.

.2 Zinc coated steel sheet: quality to ASTM A653/A653M, with Z275 designation coating, minimum 30% recycled content.

.4 Welding Materials: to CSA W59 and certified by Canadian Welding Bureau.

.5 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected with minimum zinc coating thickness of 0.008 mm, length as required for minimum 12.7 mm penetration into stud.

.6 Anchors: concrete expansion anchors or other suitable drilled type fasteners.

.7 Bolts, nuts, washers: hot dipped galvanized to ASTM A123/A123M, 600 g/m² zinc coating, Coating Grade 55.

.8 Touch up primer: zinc rich, to CAN/CGSB-1.181.

.9 Thermal insulation: in accordance with Section 07 21 16 and 07 21 29.03.

2.2 STEEL STUD DESIGNATIONS

.1 Colour code: to CSSBI Technical Bulletin Vol.7, No. 2.

2.3 METAL FRAMING

.1 Steel studs: to CSA S136 and CSA S136S1, fabricated from metallic coated steel, depth as indicated.
.1 Minimum steel thickness of 1.09 mm.

.2 Stud tracks: fabricated from same Material and finish as steel studs, depth to suit.
.1 Bottom track: single piece.
.2 Top track: 2 piece telescoping.

.3 Bridging: fabricated from same Material and finish as studs, 38 x 12 x 1.09 mm minimum thickness.

.4 Angle clips: fabricated from same Material and finish as studs, 38 x 38 mm x depth of steel stud, 1.37 mm minimum thickness.

.5 Tension straps and accessories: as recommended by manufacturer.

2.4 SOURCE QUALITY CONTROL

.1 Ensure mill reports covering Material properties are reviewed by Departmental Representative.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for precast concrete installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

.1 Weld in accordance with CSA W59.

.2 Certification of companies: to CSA W47.1 for fusion welding and CSA W55.3 for resistance welding.

.3 Do structural metal stud framing Work to CSSBI S5.

3.3 ERECTION

.1 Erect components to requirements of reviewed shop drawings.

.2 Anchor tracks securely to structure at 800 mm on centre maximum, unless lesser spacing prescribed on shop drawings.

.3 Erect studs plumb, aligned and securely attached with 2 screws minimum.

.4 Seat studs into bottom tracks and 2 piece telescoping top track.

.5 Install 50 mm minimum telescoping track at top of walls where required to accommodate vertical deflection.
.1 Nest top track into deflection channel minimum of 30 mm and maximum of 40 mm.
.2 Do not fasten tracks together.
.3 Stagger joints.

.6 Install studs at not more than 50 mm from abutting walls, openings, and each side of corners and terminations with dissimilar Materials.

.7 Brace steel studs with horizontal internal bridging at 1500 mm maximum.
.1 Fasten bridging to steel clips fastened to steel studs with screws or by welding.

.8 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.

.9 Touch up welds with coat of zinc rich primer.

.10 Erection tolerances:
.1 Plumb: not to exceed 1/500th of member length.
.2 Camber: not to exceed 1/1000th of member length.
.3 Spacing: not more than +/- 3 mm from design spacing.
.4 Gap between end of stud and track web: not more than 4 mm.

.11 Cutouts:

.1 Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

.2 Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer's verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits to review Work as follows.

.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by structural metal stud installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM).
.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM A276/A276M-17, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
.3 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.2 Canadian Standards Association (CSA International).
.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA S16-19, Design of Steel Structures.
.3 CSA S136-16, North American Specification for the Design of Cold Formed Steel Structural Members including CSA S136S1:19 Supplement 1.
.4 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
.5 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

.3 Green Seal Environmental Standards (GS).
.1 GS-11-2015, Paints and Coatings.

.4 Ontario Ministry of Labour, Training, and Skills Development (MoLTSD).
.1 Engineering Data Sheet 2-04, Fixed Access Ladders.

.5 The Master Painters Institute (MPI).
.1 Architectural Painting Specification Manual – 2020 plus amendments.

1.2 DESIGN REQUIREMENTS

.1 Design details and connections, where not shown on Drawings, in accordance with CSA S16, CSA S136 and CSA S136S1.

.2 Design fixed ladders in accordance with Ministry of Labour, Training, and Skills Development (MoLTSD) Engineering Data Sheet 2-04.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for finishes, coatings, primers, and fasteners and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS SDS.
.1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate Materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.4 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.5 Certifications: submit product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W, minimum 30% recycled content.

.2 Stainless steel shapes: A276/A276M, Type 304, finish to AISI No. 4. Sizes and shapes as shown.

.3 Welding Materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate Work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble Work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2, Coating Grade 85, to ASTM A123/A123M.

.2 Shop coat primer: In accordance with MPI-EXT and INT 5.1B and chemical component limits and restrictions requirements and VOC limits of GS-11.

.3 Zinc primer: zinc rich, ready mix in accordance with MPI-EXT and INT 5.2C and chemical component limits and restrictions requirements and VOC limits of GS-11.

2.4 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum to GS-11.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

2.5 STAINLESS STEEL ANGLES

.1 Stainless steel, sizes indicated for openings. Provide 150 mm minimum bearing at ends.

.2 Weld or bolt back-to-back angles to profiles as indicated.

2.6 CHANNEL FRAMES

.1 Fabricate frames from structural steel, sizes of channel and opening as indicated, selected for trueness of web and flange, with joints welded and ground smooth.

.2 Supply bar stop and bent bar anchors for anchorage to masonry or concrete as required. Fit frames with temporary spreaders to prevent frame from springing out of shape.

.3 Finish: Galvanized.

2.7 MILLWORK COUNTER SUPPORTS

.1 Provide supports for millwork counters. Construct supports of sizes as detailed. Where indicated, conceal supports within cavity of drywall partition.

.2 Provide all drill holes required for concealed anchorage of counters and for anchoring to building structure.

2.8 EXTERIOR SOFFIT SUPPORTS

.1 Support framing for soffits: Structural channel and angle framing continuously welded and securely anchored back to structure.

.2 Design framing and anchorage to support assembly dead loads and live loads, and lateral loads.

.3 Finish: Galvanized.

2.9 MISCELLANEOUS STEEL BRACKETS, SUPPORTS AND ANGLES

.1 Supply and install or supply for installation by trades responsible, all loose steel brackets, supports and angles where indicated, except where such brackets, supports and angles are specified under Work of other Sections. Drill for countersunk screws, expansion anchors and anchor bolts.

.2 Unless otherwise specified, prime paint for interior installation; galvanized finish for exterior and humid area installation.

2.10 EXTERIOR FIXED ACCESS LADDER

.1 Supply and install exterior stainless steel ladder, location as indicated on Drawings. Final location to be confirmed by Departmental Representative.

.2 Fabricate complete with steel stiffeners, rungs, angle rails, bent plate straps or angle brackets as shown.

.3 Provide safety cages around ladders where indicated on Drawings, in accordance with Ministry of Labour requirements.

.4 Finish coat colour to match adjacent exterior wall.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

.2 Refer to Drawings for Structural requirements prior to installation of fixed access ladders.

3.2 ERECTION

.1 Install metal fabrications in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Do welding Work in accordance with CSA W59 unless specified otherwise.

.3 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.4 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.5 Exposed fastening devices to match finish and be compatible with Material through which they pass.

.6 Supply components for Work by other trades in accordance with shop drawings and schedule.

.7 Make field connections with screws and bolts to CSA S16 for interior connections. Weld field connections for exterior Work, unless otherwise found unacceptable by the Departmental Representative.

.8 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.9 Prior to installing angles at new louvres and scuppers in former lighthouse dwelling, scan concrete for rebar and obtain Engineers review to locate in existing walls.

.10 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.1 Primer: maximum VOC limit 250 g/L to GS-11.

.11 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
.1 Primer: maximum VOC limit 250 g/L to GS-11.

3.3 CHANNEL FRAMES

.1 Install steel channel frames to openings as indicated.

3.4 FIXED ACCESS LADDERS

.1 Install fixed access ladders in accordance with reviewed shop drawings and manufacturer's written instructions. Refer to Drawings for structural requirements prior to installation.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by metal fabrications installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM):
.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
.3 ASTM E84-18b, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 American Wood Protection Association (AWPA):
.1 AWPA P5-15, Standard for Waterborne Preservatives.
.2 AWPA P8-14, Standard for Oil-Borne Preservatives.

.3 Canadian Standards Association (CSA International):
.1 CSA O80 Series-15(R2020), Wood Preservation.
.2 CSA O86:19, Engineering Design in Wood.
.3 CSA O112 Series M1977(R2006), CSA Standards for Wood Adhesives.
.4 CSA O121-17, Douglas Fir Plywood.
.5 CSA O141:05(R2019), Softwood Lumber.
.6 CSA O151-17, Canadian Softwood Plywood.
.7 CSA O325.0-92(R2003), Construction Sheathing.
.8 CAN/CSA-Z809-16, Sustainable Forest Management.

.4 Forest Stewardship Council (FSC)
.1 FSC-STD-CAN-1-2018 EN V1-0, FSC National Forest Stewardship Standard of Canada
.2 FSC-STD-20-002-2010, Structure and Content of Forest Stewardship Standards V3-0.
.3 FSC Accredited Certified Bodies.

.5 National Building Code of Canada (NBC), 2015.

.6 National Lumber Grades Authority Standard Grading Rules for Canadian Lumber, GR-2017.

1.2 QUALITY ASSURANCE

.1 Quality control requirements shall be in accordance with Section 01 45 00.

.2 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.3 Lumber Supplier to be in accordance with CAN/CSA-Z809 and FSC.

.4 Plywood in accordance with CSA and FSC standards.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with manufacturer's written instructions and Section 01 61 00.

.2 Protect all wood products from the elements as required to maintain their integrity.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Lumber: grade marked to conform to CSA O141; kiln dried; SPF no. 2 or better; moisture content not to exceed 19% at time of manufacture and installation; unless noted otherwise.

.2 Plywood sheathing: to CSA O151, softwood spruce or CSA O121 Douglas Fir, urea formaldehyde free adhesive, good one side grade. Thickness as indicated on drawings.

.3 OSB sheathing: to CSA O325.0, engineered, mat-formed panel product made of strands, flakes or wafers sliced from small diameter, round wood logs and bonded with an exterior-type binder under heat and pressure. Thickness as indicated on drawings.

.4 Laminated Veneer Lumber (LVL): Minimum grade 2.0E, 2500Fb (Fb=31.9MPa) or better.

.5 Parallel Strand Lumber (PSL): Minimum grade 2.0E, 2900Fb (Fb=37MPa) or better.

.6 Laminated Strand Lumber (LSL): Minimum grade 1.3e, 1700fb (fb=29.7MPa) or better.

.7 Wood connectors: Installed in accordance with manufacturer's requirements.

.8 Fastenings: to CSA 086.
- .1 Nails:
  - .1 Common round steel wire nails.
  - .2 Substitution of common nails with power driven nails of the same length and diameter is acceptable. Substitution of power driven nails of smaller diameter must be approved in writing by the Departmental Representative prior to use. Power driven nails shall not be over-driven into wood or sheathing.
- .2 Wood bolts: ASTM A307.

.9 Field applied wood preservative: copper napthenate to AWPA P8, green colour.

.10 Preservative treated plywood: Douglas Fir to CSA O121, G1S good one side, pressure treated with CCA to CSA O80.9, minimum retention 4.0 kg/m3 by assay.
.1 Preservative: chromated copper arsenate (CCA) to AWPA P5 as amended by CSA O80-Series.

.11 Preservative treated lumber: grade marked to conform to CSA O141; kiln dried; SPF no. 2 or better; moisture content not to exceed 19% at time of manufacture and installation, unless noted otherwise.
.1 Preservative: chromated copper arsenate (CCA) to AWPA P5 as amended by CSA O80-Series. minimum retention 4.0 kg/m3 by assay.

.12 Fire retardant treated plywood: Douglas Fir to CSA O121, G1S, fire retardant treated to CSA O80.27, maximum flame spread 25, maximum smoke developed 25 in accordance with ASTM E84.
.1 Backboard: Thickness as indicated, sanded, to Table E-1. Provide fire rated plywood (PLY) in thickness of 12.7 mm in locations as indicated.

.13 Sealant: one-component, acrylic base, solvent curing to CGSB 19-GP-5M, Ecologo certified.

.14 Construction adhesive: to CSA O112 Series, cartridge loaded.
.1 Maximum allowable VOC limit 140 g/L.
.2 Adhesives and Sealants Applications.

.15 Hot dip galvanizing: ASTM A123/A123M, minimum zinc coating of 600 g/m². for all exterior steel timber connection components, unless noted otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for carpentry installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Unless noted otherwise, all wood framing details to be in accordance with Part 9, Division B of the National Building Code.

.2 Apply wood preservative to wood in contact with roofing, concrete and masonry.

.3 Treat surfaces of pressure treated wood and plywood which are cut or bored after pressure treatment with field applied wood preservative.

.4 Set items in place plumb, straight and level to a tolerance of 1:600 and rigidly secure in place.

.5 Construct continuous members from pieces of longest practical length.

.6 Install spanning members with "crown-edge" up.

.7 Select exposed framing for appearance. Install lumber and panel Materials so that grade-marks and other defacing marks are concealed or are removed by sanding where Materials are left exposed.

.8 Secure exterior Work with galvanized or non-ferrous fasteners.

.9 Apply continuous bead of sealant at junction between roof deck and abutting parapet wall.

.10 Install plywood backboards with countersunk screws.

.12 Proposed notching and drilling of joist members must be submitted to the Departmental Representative for their review.

.13 All components of built up members to be continuous for full span. Do not splice or use butt joints.

.14 Built-up beams to be fastened as per typical detail TW-FAST-02.

.15 Use joists hangers where joists frame into sides of supports.

.16 All components of built up members to be continuous for full span. Do not splice or use butt joints.

.17 Provide solid blocking between joists at interior supports, and provide cross-bridging between joists at maximum 2100 mm on centre along length of span, unless noted otherwise.

.19 Distribute hanger loads from mechanical and heavy electrical services suspended from steelwork uniformly along members. Alternate hanger position on either side of members.

.20 Connect hangers for mechanical and electrical services and other non-structural elements not to cause twisting of steel members or excessive bending of member flanges.

.21 Do not apply lateral loads to members unless approved by the Departmental Representative.

3.3 POST-INSTALLED ANCHORS AND DOWELS

.1 Anchors located outside the building envelope's vapour barrier to be hot dip galvanized or stainless steel.

.2 Concrete to be minimum 28 days old at the time of anchor installation.

.3 Use drilling and installation tools and procedures per manufacturer's recommendations. Do not core drill unless specifically noted on drawings. Hole diameters not to exceed those required by manufacturer.

.5 Anchor and dowel capacity shall be dependent upon spacing between adjacent anchors and their proximity to concrete. All anchors shall be installed with clearances and edge distances indicated on drawings.

.6 Do not cut reinforcement to accommodate drilled anchors and dowels. Scan the structure to locate reinforcement prior to fabricating structural steel fastened by drilled anchors.

.7 When obstructions prevent drilling holes in specified locations to the required depth, relocate at no extra cost to the Contract. Obtain Departmental Representative's approval of new locations before drilling; modifications to connected members and additional anchors/dowels may be required. Fill abandoned holes which are closer than 3 times the hole diameter from the relocated anchors with epoxy adhesive. Do not tighten anchors until the adhesive has fully cured.

.8 Do not weld to plates fastened with adhesive anchors after the adhesive is placed.

.9 Unless otherwise noted on drawings, minimum embedment lengths for post-installed anchors to be:
.1 12 mm diameter, expansion anchors: 83 mm, adhesive anchors: 114 mm.
.2 16 mm diameter, expansion anchors: 102 mm, adhesive anchors: 143 mm.
.3 19 mm diameter, expansion anchors: 121 mm, adhesive anchors: 171 mm.

.10 Do not bend post installed dowels and rods after installation.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute/ Builders Hardware Manufacturers Association/ National Electrical Manufacturers Association. (ANSI/BHMA/NEMA):
- .1 ANSI/BHMA A156.9-2015, Cabinet Hardware.
- .2 ANSI/BHMA A156.11-2019, Cabinet Locks.
- .3 ANSI/BHMA A156.16-2018, Auxiliary Hardware.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC)/Woodwork Institute (WI).
- .1 AWMAC/WI NAAWS 3rd Edition-2017.

.3 Canadian Standards Association (CSA).
- .1 CSA B651-18 Accessible Design for the Built Environment.
- .2 CSA O112 Series M1977(R2006), CSA Standards for Wood Adhesives.
- .3 CSA O121-17, Douglas Fir Plywood.
- .4 CSA Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings.

.4 National Electrical Manufacturers Association (NEMA).
- .1 NEMA LD 3-2005, High-Pressure Decorative Laminates.

.5 National Lumber Grading Rules (NLGA).
- .1 Standard Grading Rules for Canadian Lumber, 2017.

1.2 IAQ - INDOOR AIR QUALITY

.1 Comply with CSA Z204, Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 and AWMAC/WI NAAWS Section 1.

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS SDS.

.3 Shop Drawings:
- .1 Submit two copies of drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
  - .1 Scales: profiles full size, details half full size.
- .3 Indicate Materials, thicknesses, finishes and hardware.

.4 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into Work.
.3 Submit duplicate samples of hardwood, softwood, plywood and MDF sample size 300 x 300 mm or 300 mm long.
.4 Submit duplicate samples of laminated plastic for colour selection.
.5 Submit duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

.5 Certifications: submit AWMAC GIS certificates signed by manufacturer certifying that Materials comply with specified performance characteristics and physical properties.
.1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC/WI NAAWS and shall be subject to an inspection at the plant and/or site by an appointed AWMAC Certified Inspector.
.2 Inspection costs shall be included in the bid price for this project. Contact your local AWMAC Chapter for details of inspection costs.
.3 Shop drawings shall be submitted to the AWMAC Chapter office for review before Work commences.
.4 Work that does not meet the AWMAC/WI NAAWS, as specified, shall be replaced, reworked and/or refinished by the architectural woodwork Contractor, to the approval of AWMAC, at no additional cost to the. Departmental Representative.
.5 If the woodwork Contractor is an AWMAC Manufacturer member in good standing, a two (2) year AWMAC Guarantee Certificate will be issued.
.6 The AWMAC Guarantee shall cover replacing, reworking and/or refinishing any deficient architectural woodwork due to faulty workmanship or defective Materials supplied by the woodwork Contractor, which may appear during a two (2) year period following the date of issuance.
.7 If the woodwork Contractor is not an AWMAC Manufacturer member they shall provide the Departmental Representative with a two (2) year maintenance bond, in lieu of the AWMAC Guarantee Certificate, to the full value of the architectural woodwork contract.

1.4 ACCESSIBILITY

.1 Comply with CSA B651, Accessible Design for the Built Environment.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with AWMAC/WI NAAWS, Premium Grade, except as indicated otherwise.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle architectural woodworking in accordance with Section 01 61 00 and AWMAC/WI NAAWS.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Management and Disposal:
.1 Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Exposed hardwood: to AWMAC/WI NAAWS, Section 3: kiln dried wood, moisture content 6-12%, premium grade, White Oak, unless otherwise indicated.

.2 Exposed softwood:
.1 S-DRY, graded and stamped to NLGA, GR, 202c. "C" CEDAR, INDUSTRIAL CLEAR.

.3 Concealed blocking and framing: S-DRY, graded and stamped to NLGA, SPF, 121c. "STUD" and 101d. "D" FINISH.

.4 Exposed plywood (WV): hardwood plywood to AWMAC/WI NAAWS, Section 4 Sheet Products, Premium Grade, White Ash.
.1 Wood veneer cut: White Ash.
.2 Panel adhesive: Type to suit condition.

.5 Concealed plywood: douglas fir to CSA 0121, Good One Side, urea formaldehyde free adhesive.

.6 High pressure decorative laminate (PL): to AWMAC/WI NAAWS, Section 4, and NEMA LD3 as follows:
.1 Flatwork face sheet: 1.2 mm thick, heavy wear resistance.
.2 Vertical interior face sheets: 0.8 mm thick.
.3 Postformed face sheet: 0.8 mm thick.
.4 Backing sheet: Thickness to match face sheet, high pressure laminate, manufactured by same manufacturer as face sheet.
.5 Plastic laminate: Refer to Interior Finish Schedule for plastic laminate types, colours and finishes.

.7 Plastic laminate panel core: to AWMAC/WI NAAWS Section 4.
.1 Veneer core: veneer core plywood, urea formaldehyde free, to AWMAC/WI NAAWS, in sizes, thickness and shapes as indicated.

.8 Panel adhesive: to AWMAC/WI NAAWS Section 4, Ecologo certified.

.9 Sealant: In accordance with Section 07 92 00.

.10 Bituminous paint: acid and alkali resistant, Ecologo certified.

.11 Construction adhesive: to CSA O112 Series, cartridge loaded.
.1 Maximum allowable VOC limit 140 g/L.
.2 Adhesives and Sealants Applications.

.12 Metal fabrications: In accordance with Section 05 50 00 as required for miscellaneous metal supports required for architectural woodwork.

2.2 HARDWARE

.1 Cabinet hinge: to ANSI/BHMA-A156.9, type B81602, frame style cabinets, European cabinet construction, adjustable.

.2 Magnetic catch: to ANSI/BHMA-A156.9, type B13171, heavy duty.

.3 Recessed pull: to ANSI/BHMA-A156.9, type B02201, in shape as approved by the Departmental Representative.

.4 Adjustable shelf standard: to ANSI/BHMA-A156.9, type B84061, surface application, open shelf rest type B84091.

.5 Drawer slide set: heavy duty to ANSI/BHMA-A156.9, type B05051, with zinc plate finish and AWMAC/WI NAAWS Section 10 and Appendix B Section 10-Casework, Drawer Slide Selection Guide, full extension, positive stop, self-closing.
.1 AWS Heavy Duty:
.1 Static load capacity: 45.359 kg Commercial.
.2 Dynamic load capacity: 34.019 kg 50,000 cycles.

.6 Cam locks: to ANSI/BHMA-A156.11, key removable in locked and unlocked position, cam attached with screw or nut, type E07261, Grade 1.

.7 Coat hooks: to ANSI/BHMA-A156.16, type L13111.

.8 Closet bar: to ANSI/BHMA-A156.16, attached by surface screws, round type.

.9 Draw bolts: type recommended by laminated plastic manufacturer.

.10 Sliding closet door hardware: Complete enclosed and hanging upper track mounting system. Refer to Section 08 71 11 for hardware.

.11 Cord grommet: friction fit, PVC grommet and cap, 75 mm diameter, colour as approved by the Departmental Representative.

2.3 FABRICATION

.1 Finished millwork shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for uniformity in colour, grain and texture.

.2 Perform plastic laminate Work in accordance with AWMAC/WI NAAWS and NEMA LD3.

.3 Casework: to AWMAC/WI NAAWS, Section 10, Type: High Pressure Decorative Laminate, Custom Grade: Section 10 and CSA B651.

.4 Countertops: to AWMAC/WI NAAWS, Section 11 and Appendix B Section 11, Custom Grade, HDPL Option 6 post formed edge with coved splash and CSA B651.
.1 Front edge option: 4 waterfall.

.2 Sink cutouts: to 4.3.6 and radius corners to Appendix B.

.5 Shop assemble units in size to allow passage to installed location.

.6 Match grain and colour of adjoining exposed natural finished wood.
.1 Before finishing exposed surfaces of woodwork: remove handling marks or effects of exposure to moisture by thorough final sanding over all surfaces of exposed portions, using appropriate grit sandpaper and clean before applying sealer or finish.

.7 Cover exposed faces and edges with laminated plastic where indicated.

.8 Shop apply laminated plastic with hairline joints, chamfer exposed edges.

.9 Apply bituminous paint to edge of cutouts in laminated plastic tops at sinks.

.10 Provide shelves and shelf gables as indicated.

.11 Fabricate bases, sills, surrounds, frames, benches and similar carpentry items as required for this Work and as shown on Contract Drawings.

.12 Wood base (WB): Fabricate wood base to match existing type.

.13 Baseboard reproduction: White Oak at Former light keepers dwelling.

.14 Seal all surfaces for site finishing to AWMAC/WI NAAWS Section 5.

2.4 SHOP FINISHING

.1 Shop finish exposed hardwood with water based polyurethane to AWMAC/WI NAAWS Section 5, System 12.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 HARDWARE SCHEDULE

.1 Swinging doors:
.1 1 pair cabinet hinges.
.2 1 cabinet pull.
.3 1 magnetic catch.

.4 1 door lock.

.2 Drawers:
.1 1 drawer slide set.
.2 1 cabinet pull.
.3 1 drawer lock.

.3 Adjustable shelves:
.1 4 shelf standards.
.2 4 rests per shelf.

.4 Pivot sliding cabinet door:
.1 3 pair cabinet hinges.
.2 2 cabinet pull.
.3 Two-wheeled trolley
.4 Steel jambs.
.5 Aluminum header.
.6 Top track.
.7 Bottom and upright guides.
.8 Stop damper
.9 Cover plates.
.10 Self-closing system

3.3 INSTALLATION

.1 Set items in place, plumb, straight and level to a tolerance of 1:400 and rigidly secure in place in accordance with AWMAC/WI NAAWS.

.2 Completely assemble units.

.3 Join abutting laminated plastic tops with draw bolts.

.4 Door frames:
.1 Butt and cope internal joints of door frames to make snug, tight, joint. Cut right angle joints with mitred joints.
.2 Fit backs of frames snugly to wall surfaces to eliminate cracks at junction of frame with walls.

.5 Sills: Install window sills level, plumb and even in locations as indicated and ensure that sills are securely fastened.

.6 Apply sealant to junction of backsplash and adjacent wall finish in accordance with Section 07 92 00.

.7 Adjust hardware after cabinets installed for smooth effortless operation.

.8 Fastening:
.1 Coordinate wall securement, anchorage, and blocking for architectural woodwork items.
.2 Position items of architectural woodwork accurately, level, plumb, true and fasten or anchor securely.
.3 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
.4 Provide heavy duty fixture attachments for wall mounted cabinets.

.5 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match Material being secured.

.9 Remove and replace damaged, marked, or stained architectural woodwork.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by architectural woodwork installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International Inc.
.1 ASTM D6162/D6162-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.

.2 Canadian General Standards Board (CGSB)
.1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
.2 CGSB 37-GP-56M-80(1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting one week prior to beginning waterproofing Work, with waterproofing Contractor's representative and Departmental Representative in accordance with Section 01 31 19 to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide two copies of most recent technical waterproofing components data sheets describing Materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Provide two copies of WHMIS SDS and indicate VOC content for:
.1 Primers.
.2 Asphalt.
.3 Sealers.
.4 Filter fabric.

.3 Manufacturer's Certificate: certify that products meet or exceed specified requirements.

.4 Test and Evaluation Reports: submit laboratory test reports certifying compliance of membranes with specification requirements.

.5 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.

.6 Manufacturer's field report: in accordance with Section 01 45 00.

.7 Reports: indicate procedures followed, ambient temperatures and wind velocity during application.

1.4 FIRE PROTECTION

.1 Fire Extinguishers:
.1 Maintain one cartridge operated type or stored pressure rechargeable type with hose and shut-off nozzle,
.2 ULC labelled for A, B and C class protection.
.3 Size 4.5 kg or as indicated, within 6 m of torch applicator.

.2 Maintain fire watch for 1 hour after each day's waterproofing operations cease.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.

.3 Remove only in quantities required for same day use.

.4 Place plywood runways over completed Work to enable movement of Material and other traffic.

.5 Store sealants at +5 degrees C minimum.

.6 Handle waterproofing Materials in accordance with manufacturer's written directions, to prevent damage or loss of performance.

.7 Store and manage hazardous Materials in accordance with Section 01 35 29.

.8 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging Materials in accordance with Section 01 74 20.
.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
.2 Fold up metal banding, flatten and place in designated area for recycling.

1.6 FIELD CONDITIONS

.1 Ambient Conditions: Do not install waterproofing when temperature remains below -18°C for torch application.

.2 Install waterproofing on dry walls, free of snow and ice, use only dry Materials and apply only during weather that will not introduce moisture into waterproofing system.

1.7 WARRANTY

.1 For Work of this Section 07 13 52 - Modified Bituminous Sheet Waterproofing, 12 months warranty period is extended to 24 months.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

.1 Waterproofing System: capable of resisting moisture/water head of 3000 mm, and preventing moisture migration to interior.

.2 Compatibility between components of waterproofing system is essential. Provide written declaration to Departmental Representative stating that Materials and components, as assembled in system, meet this requirement.

2.2 DECK PRIMER

.1 Asphalt primer: to CGSB 37-GP-9Ma.

2.3 MEMBRANE

.2 Waterproofing sheet membrane: to CGSB 37-GP-56M, combination of polyester and glass fibres to ASTM D6162/D6162M.
.1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, glass and polyester reinforcement, having nominal weight of 200 g/m².
.2 Type 1, fully adhered.
.3 Class A-granule surfaced, Colour for granular surface: To later selection by Departmental Representative.
.4 Grade 2 - heavy duty service.
.5 Bottom surface: polyethylene.

2.4 SEALING COMPOUND

.1 Sealing compound: Polymer modified sealing compound, type as recommended by waterproofing manufacturer.

PART 3 - EXECUTION

3.1 QUALITY OF WORK

.1 Do priming for waterproofing in accordance with manufacturer's written recommendations.

.2 Assembly, component and Material connections will be made in consideration of appropriate design loads.

3.2 EXAMINATION OF SURFACES

.1 Verification of Conditions: Inspect with Departmental Representative surface conditions to determine readiness to proceed.

.2 Evaluation and Assessment: prior to beginning of Work ensure surfaces are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

.3 Do not install waterproofing Materials during rain or snowfall.

3.3 PROTECTION OF IN-PLACE CONDITIONS

.1 Use warning signs and barriers. Maintain in good order until completion of Work.

.2 Clean off drips and smears of bituminous Material immediately.

.3 At end of each day's Work or when stoppage occurs due to inclement weather, provide protection for completed Work and Materials out of storage.

3.4 PRIMING

.1 Apply primer to concrete waterproofing substrate at the rate recommended by manufacturer.

3.5 PROTECTED MEMBRANE APPLICATION

.1 Membrane application:

.1 Install Materials in accordance with manufacturer's instructions.

.2 Install membrane free of blisters, wrinkles and fishmouths in accordance with membrane manufacturer's instructions. Avoid asphalt seepage at seams greater than 5 mm.

.3 Unroll waterproofing membrane dry over concrete for alignment. Torch membrane to substrate and torch side and end laps of the membrane.

.4 At interior and exterior corners or in areas of potentially high substrate stresses, place reinforcing membrane strips in widths wide enough to bear minimum 150 mm on each surface per manufacturer’s recommendations.

.5 Unroll waterproofing membrane dry over wall for alignment and cut in maximum length of 2000 mm. Reroll membrane when properly aligned. Starting at the base of the wall, torch membrane to substrate in locations indicated.

.6 Torch waterproofing membrane horizontally and to shed water. Waterproofing membrane shall have edge laps of 75 mm and end laps of 150 mm. Stagger end laps a minimum of 25%.

.7 Embed surface granules on end laps by heating and using a round-nosed trowel.

.8 Penetrations: Seal around penetrations in accordance with the manufacturer's recommendations and details.

3.9 FIELD QUALITY CONTROL

.1 Inspections:

.1 Inspection and testing of waterproofing application will be carried out by testing laboratory designated by Departmental Representative.

.2 Departmental Representative will pay for tests as specified in Section 01 45 00.

3.10 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

.1 Place Materials defined as hazardous or toxic in designated containers.

.2 Clearly label location of salvaged Material's storage areas and provide barriers and security devices.

.3 Ensure emptied containers are sealed and stored safely.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM).
.1 ASTM F449-16, Standard Practice for Subsurface Installation of Corrugated Polyethylene Pipe for Agricultural Drainage or Water Table Control.

.2 Canadian General Standards Board (CGSB).
.1 CGSB 71-GP-24M-AMEND-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Safety Data Sheets (SDS).

.4 Underwriters Laboratories of Canada (ULC).
.1 CAN/ULC-S701.1-17, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
.2 CAN/ULC-S702.1:2014-AMD1, Standard For Mineral Fibre Thermal Insulation For Buildings, Part 1: Material Specification.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for board insulation and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit duplicate copies of WHMIS SDS. Indicate VOC's during application and curing.

.3 Samples:
.1 Submit 300 x 300 mm sample of each board insulation.

.4 Certificates:
.1 Submit product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports:
.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect specified Materials from damage.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 INSULATION

.1 Extruded polystyrene (XPS): to CAN/ULC-S701.1.
.1 Type: 4.
.2 Compressive strength: 207 kPa.
.3 Thickness: as indicated.
.4 Thermal value: Minimum RSI of 0.87 per 25 mm.
.5 Edges: shiplapped.

.2 Semi-rigid insulation:
.1 Semi-rigid stone wool conforming to CAN/ULC-S702.1, Type 1, minimum density 70 kg/m^3.
.2 Thickness: as indicated.
.3 Thermal value: Minimum RSI of 0.75 per 25 mm at 24 deg. C.

.3 Cement faced insulation:
.1 CAN/ULC-S701.1, Type 4; extruded, closed-cell, cellular, foamed polystyrene with ship-lapped edges, prefinished with a cement facing.
.2 Provide 8 mm thick latex modified concrete face having a slightly broomed finish.
.3 Compressive strength: 241 kPa.
.4 Thickness: as indicated.
.5 Thermal value: Minimum RSI of 0.88 per 25 mm.

2.2 ACCESSORIES

.1 Adhesive (for polystyrene): to CGSB 71-GP-24M and as recommended by insulation manufacturer.

.2 Insulation fasteners (semi-rigid insulation): Stick clip/pin fasteners as recommended by insulation manufacturer suitable for intended condition.

.3 Foundation insulation fastening system: Provide purpose made galvanized steel clips and continuous galvanized steel flashing as recommended by insulation manufacturer.

.4 Drainage board: High-strength, non-woven drainage panel consisting of a polypropylene core with a factory-laminated geotextile complete with adhesive or fasteners as required for installation.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for board insulation application in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install insulation after building substrate Materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 PERIMETER FOUNDATION AND UNDER SLAB INSULATION

.1 Perimeter foundation insulation (exterior application):
.1 Unless otherwise indicated, extend boards from top of foundation wall down to top of footing. Install on exterior face of perimeter foundation wall with clips and adhesive.
.2 Provide rigid insulation below grade and cement faced insulation with caulked joints extending down minimum 600 mm below finished grade. Caulking of cement faced insulation to be grey to match concrete face colour.
.3 Protect entire face of insulation exposed to backfill (below grade) with drainage board.

.4 Drainage board:
.1 Install drainage board in accordance with ASTM F449 and manufacturer's written instructions.
.2 Drainage board shall extend full height of foundation wall to top of footing where indicated on Drawings.
.3 Position panel with flat side against wall and filter fabric toward soil/drainage side and attach to foundation wall using manufacturer approved fastening system.

.2 Under slab application (extruded polystyrene):
.1 Extend boards in from perimeter foundation wall as indicated.
.2 Lay boards on level compacted fill.

3.4 CAVITY WALL INSTALLATION

.1 Install semi-rigid insulation boards tight to the inner wall assembly as shown on contract Drawings starting at the base of the wall in parallel courses with tight butt joints. Stagger end joints in adjacent course.

.2 Provide finish Work level, plumb and true.

.3 Provide securement for cavity wall insulation with manufacturer recommended insulation fasteners suitable for intended condition and in accordance with manufacturer’s written instructions.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM).
.1 ASTM C665-17, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
.2 ASTM C1320-10(2016), Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.2 Underwriters Laboratories of Canada (ULC).
.1 CAN/ULC-S702.1:2014-AMD1, Standard For Mineral Fibre Thermal Insulation For Buildings, Part 1: Material Specification.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for blanket insulation and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates:
.1 Submit product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.4 Test Reports:
.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect specified Materials from damage.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 INSULATION

.1 Batt and blanket mineral fibre (non-rated): to CAN/ULC-S702.1, friction fit.
  .1 Type: 1.
  .2 Thickness: as indicated.

.1 Batt and blanket mineral fibre (fire-rated/acoustic): to ASTM C665, paperless, semi-rigid, spun stone wool fibre mats.
  .1 Type: 1.
  .2 Thickness: as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for blanket insulation application in accordance with manufacturer's written instructions.
  .1 Visually inspect substrate in presence of Departmental Representative.
  .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.

.2 Batt insulation (non-rated, fire-rated/acoustic):
  .1 Install batt insulation in partitions, between studs, and as indicated on Contract Drawings and in accordance with the manufacturer's instructions.
  .2 Fill stud cavities to full height of partitions and carefully cut and fit required batt insulation type around services and protrusions.

.3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.4 Do not compress insulation to fit into spaces.

.5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.

.6 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM).
.1 ASTM D1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
.2 ASTM D1623-17, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
.3 ASTM D2842-12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
.4 ASTM D6226-15, Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
.5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Canadian Urethane Foam Contractors Association Inc. (CUFCA).

.3 Green Seal (GS).
.1 GS-11-2015, Standard for Paints and Coatings.

.4 Underwriters Laboratories of Canada (ULC).
.1 CAN/ULC-S101-14, Standard Methods of Fire Tests of Building Construction and Materials.
.2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.3 CAN/ULC-S705.1-15, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification. Includes Amendment 1.2.
.4 CAN/ULC-S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.
.5 CAN/ULC-S710.1-11, Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification.
.6 CAN/ULC-S710.2-11, Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 2: Installation.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for polyurethane foam sprayed insulation and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit duplicate copies of WHMIS SDS in accordance with Section 01 35 29.

.3 Test Reports:
.1 Submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
.2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

.4 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.5 Manufacturer's Reports:
.1 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
.2 Site inspection shall be carried out at 5%, 50% and 95% completion to verify conformance with CAN/ULC-S705.2, manufacturers written instructions and this Section.

1.3 QUALITY ASSURANCE

.1 Applicators to conform to CUFCA Quality Assurance Program.

.2 Qualifications:
.1 Installer: person specializing in sprayed insulation installations approved by manufacturer.
.2 Manufacturer: company with experience in producing of Material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.

.3 Mock-up:
.1 Construct mock-up in accordance with Section 01 45 00.
.2 Construct mock-up 3 m^2 minimum, of sprayed insulation including one inside corner and one outside corner, and door and window openings.
.3 Mock-up may be part of finished work.
.4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sprayed insulation work.

.4 Health and Safety Requirements: worker protection:
.1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
.2 Workers must wear gloves, dust masks and protective clothing when applying foam insulation.
.3 Workers must not eat, drink or smoke while applying foam insulation.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect specified Materials from damage.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.5 SITE CONDITIONS

.1 Ventilate area in accordance with Section 01 51 00.

.2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.

.3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation Materials.

.5 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Sprayed foam insulation (typical applications): Sprayed/frothed polyurethane foam conforming to CAN/ULC-S705.1. and containing no fluorocarbons and conforming to the following minimum requirements:
.1 Density to ASTM D1622: 28.9 kg/m^3.
.2 Open cell content to ASTM D6226: 6%.
.3 Tensile strength to ASTM D1623: 325 kPa.
.4 Compressive strength to ASTM D1621: 201 kPa.
.5 Water absorption to ASTM D2842: 0.6% by volume.
.6 Water vapour permeance to ASTM E96: 50 mm sample 41 ng/Pa.s.m^2 (0.68 Perms).
.7 Flame spread: <500.

.2 Primers: in accordance with manufacturer's recommendations for surface conditions.
.1 Maximum VOC limit 100 g/L to GS-11 Standard.

.3 Foam insulation (kits): CAN/ULC-S710.1, closed cell, polyurethane foam-in-place moisture cured sealant insulation, CFC free, 16 kg per m^3 to 32 kg per m^3 density; injected from prepackaged pressurized containers.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sprayed insulation application accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Verify substrate surfaces are solid, free from surface water, frozen matter, dust, oil, grease, scaling or laitance, projections and any other foreign matter detrimental to performance. Obtain manufacturer's approval of substrate in writing, submit copy to Departmental Representative.

.2 Provide ventilation in area to receive sprayed foam insulation, introducing and exhausting fresh air continuously during and for 24 hours after application.

.3 Provide temporary enclosures to prevent spray from contaminating air beyond application area, and damage from overspray and dusting on adjacent surfaces.

.4 Supply and install temporary protection to adjacent surfaces to prevent damage resulting from work of this Section.

3.3 SPRAYED FOAM INSULATION APPLICATION (TYPICAL, LARGE SCALE)

.1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions.

.2 Use primer where recommended by manufacturer.

.3 Apply sprayed foam insulation in thickness as indicated.

.4 Insulation to be continuous, level, plumb and uniform thickness throughout. Insulation shall be free of voids and imbedded foreign Materials.

3.4 SPRAYED FOAM INSULATION APPLICATION (KITS)

.1 Except where otherwise specified in other Sections, install foamed-in-place insulation kits fully in crevices and frame voids between exterior walls, windows and door frames, and about lintels, around louvers and around other items built into exterior walls to prevent air infiltration. Install in accordance with CAN/ULC-S710.2.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.
.1 Remove insulation Material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Architectural Manufacturers Association (AAMA).
.1 AAMA 501-15, Methods of Test for Exterior Walls.

.2 American Society for Testing and Materials (ASTM).
.1 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
.2 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.3 Canadian General Standards Board (CGSB).
.1 CGSB 71-GP-24M-1977(R1983), Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit WHMIS SDS - Safety Data Sheets.
.3 For adhesives, primers and sealants, indicate VOC in g/L during application and curing.

.3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.
.1 Existing Substrate Condition: report deviations, as described in PART 3 -EXAMINATION in writing to Departmental Representative.
.2 Certificates: submit certificates signed by manufacturer certifying that Materials comply with specified performance characteristics and physical properties.
.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
.4 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.3 QUALITY ASSURANCE

.1 Qualifications:
.1 Applicator: company specializing in performing Work of this section.
.1 Completed installation must be approved by the Material manufacturer.

.2 Mock-Up:
.1 Construct mock-up in accordance with Section 01 45 00.
.2 Construct 3 m^2 typical exterior wall panel, demonstrating as a minimum one lap joint, one inside corner, one window interface, and one electrical box; illustrating Materials interface with adjacent construction and seals.
.3 Locate where directed by the Departmental Representative.
.4 Mock-up may remain as part of finished Work if accepted by the Departmental Representative.
.5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with air/vapour barrier Work.

.3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
.2 Twice during progress of Work at 25% and 60% complete.
.3 Upon completion of Work, after cleaning is carried out.

1.4 INSPECTION

.1 Air/vapour barriers installation must be inspected by Departmental Representative before Work is covered. Notify Departmental Representative when complete installation is ready for inspection.

.2 Repair punctures, rips and tears to ensure continuity of air/vapour barrier.

.3 Where punctures and tears are extensive, replace entire damaged section.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00.

.2 Deliver, store and handle Materials in accordance with manufacturer's written instructions.

.3 Do not store Material on roof.

.4 Under cover on elevated platform.

.5 In original package, labels intact.

.6 Remove and replace damaged, wet or broken Material.

.7 Stand rolls on end, protect edges.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

.2 Place Materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.7 SITE CONDITIONS

.1 Weather and surfaces dry.

.2 Imminent weather forecast, dry.

.3 Install solvent curing sealants and adhesive Materials in open spaces with ventilation.

.4 Ventilate enclosed spaces in accordance with Section 01 51 00.

.5 Maintain temperature and humidity recommended by Materials manufactures before, during and after installation.

1.8 SEQUENCING

.1 Sequence Work in accordance with Section 01 32 16.

.2 Sequence Work to permit installation of Materials in conjunction with related Materials and seals.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Asphalt primer for self-adhesive membrane: synthetic rubber, 40% solids by weight, type as recommended by membrane manufacturer.

.2 Air/vapour barrier membrane (self-adhesive): Styrene Butadiene Styrene (SBS) self-adhesive bitumen laminated to high-density polyethylene film, nominal total thickness of 1 mm and as follows:
.1 Air permeance: no leakage up to 3000 Pa or <0.01 l/m^2.s at 75 Pa pressure differential to AAMA 501.
.2 Water vapour permeance: maximum 2.8 ng/Pa.s.m^2 to ASTM E96/E96M, procedure B.
.3 Peel adhesion: to ASTM E330/E330M.
.1 0 delamination at 3000 Pa for 5 sec.
.2 10.9 delamination at 1000 Pa for 1 hour.

.3 Adhesive: synthetic rubber, solvent type, trowel consistency to CGSB 71-GP-24M, compatible with air/vapour barrier membrane.

.4 Joint filler: extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, outsized 30 to 50%, CFC free.

.5 Fastening bar: Continuous 25 mm wide x 3 mm thick aluminum bar, predrilled for mechanical attachment.

.6 Fasteners: As specified herein or manufacturer's recommended fastener for attaching to substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for air/vapour barrier application in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.3 PREPARATION

.1 Remove loose Material and scrape surface smooth.

.2 Remove water and condensation from surfaces.

.3 Clean surfaces of foreign and bituminous substances.

.4 Roll on primer at 2 to 8 m^2/l in accordance with manufacturer's recommendations. Allow 30 minutes drying to a tacky surface. Re-prime areas not covered with membrane in 24 hours.

.5 Fill gaps and joints over 6 mm wide with joint filler. Reinforce with 305 mm wide strip of membrane.

3.4 APPLICATION

.1 Ensure services are installed and inspected prior to installation of air/vapour barrier.

.2 Install air/vapour barrier and associated Materials in accordance with manufacturer's written instructions.

.3 Reinforce inside and outside corners with 305 mm membrane.

.4 Apply self-adhesive membrane to intended substrates to maintain continuity of air/vapour barrier in accordance with manufacturer's written instructions and details.

.5 Lap side and end joints minimum 50 mm. Roll air/vapour barrier and laps for continuous adhesion over entire substrate area; use manufacturer's recommended roller

.6 Cut membrane around projections, ensuring continuous adherence to substrate. Seal self-adhesive membrane with adhesive to manufacturer's instructions.

.7 Extend air/vapour barrier as required to connect to roof parapets, windows, doors frames, and other components of Work comprising air/vapour barrier system.

.8 Mechanically attach membrane to window and door frames with pressure strips.

.9 At end of days' Work, trowel sealant water cut-off along uppermost edge of incomplete air/vapour barrier assembly, to prevent loss of adhesion and damage to air/vapour barrier.

.10 Supply and install continuous mechanical fastening bar to clamp air/vapour barrier both sides of unfilled gaps, cracks, and joints.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion and verification of performance of installation, remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.7 PROTECTION

.1 Protect finished Work in accordance with Section 01 61 00.

.2 Do not permit adjacent Work to damage Work of this section.

.3 Ensure finished Work is protected from climatic conditions.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM).
.1 ASTM E1643-18a, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
.2 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data: Submit manufacturer's printed product literature, specifications and datasheet and include:
.1 Product characteristics.
.2 Performance criteria.
.3 Limitations

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS).

.4 Quality assurance submittals:
.1 Certificates: submit certificates signed by manufacturer certifying that Materials comply with specified performance characteristics and physical properties.
.2 Laboratory Test Results: submit full set of actual test results as per paragraph 8.3 of ASTM E1745 (including all after conditioning permeance tests).
.3 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver Materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

.2 Store Materials in a clean, dry area in accordance with manufacturer's instructions.

.3 Stack membrane on smooth ground or wood platform to eliminate warping.

.4 Protect Materials during handling and application to prevent damage or contamination.

.5 Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Product not intended for uses subject to abuse or permanent exposure to the elements.

.2 Do not apply on frozen ground.

PART 2 - PRODUCTS

2.1 SHEET VAPOUR BARRIER

.1 Plastic Vapour Barrier: Vapour Barrier membrane must have the following properties:
.1 Permeance as tested after conditioning to ASTM E1745 paragraphs 7.1.2 - 7.1.5: less than 0.57 ng/(Pa*s*m2).
.2 Strength: Class A, ASTM E1745.
.3 Minimum thickness: 0.38 mm (15 mils).

2.2 ACCESSORIES

.1 Seam tape: high-density polyethylene film and a rubber-based, pressure-sensitive adhesive, specially designed to seal seams and penetration, approximate width 100 mm, by vapour barrier manufacturer.

.2 Pipe Boots: Where slab penetrations occur, construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

.3 Vapour-Proofing Mastic: use mastic provided by vapour barrier manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine surfaces to receive membrane. Notify Departmental Representative if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

.1 Prepare surfaces in accordance with manufacturer's instructions.

.2 Level and tamp or roll aggregate.

3.3 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of vapour barrier.

.2 Install in accordance with manufacturer's instructions and ASTM E1643.

.3 Unroll vapour barrier over the entire area where the slab is to be poured. Unroll vapour barrier with the longest dimension parallel with the direction of the pour. Completely cover concrete placement area.

.4 Lap vapour barrier over footings and seal to foundation walls.

.5 Overlap all joints 150 mm and seal with manufacturer's tape.

.6 Seal all penetrations (including but not limited to pipes, ducting, rebar) with manufacturer's pipe boot, or tape and mastic.

.7 No penetration of the vapour barrier is allowed except for reinforcing steel and permanent utilities.

.8 Inspect for continuity. Repair punctures and tears with sealing tape before Work is concealed. Repair damaged areas by cutting patches of vapour barrier, overlapping damaged area 150mm. Clean all adhesion areas of dust, dirt and moisture. Tape all four sides with tape.

.9 Do not proceed until repair Work has been inspected and approved by Departmental Representative.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus Materials, rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 The Aluminum Association, Inc. (AA).
.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 American Society of Mechanical Engineers (ASME).
.1 ASME B18.6.3-2013, Machine Screws, Tapping Screws, And Metallic Drive Screws (Inch Series).

.3 American Society for Testing and Materials International (ASTM).
.1 ASTM D523-14(2018), Standard Test Method for Specular Gloss.
.2 ASTM D822/D822M-13(2018), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
.3 ASTM D1781-98(2012), Standard Test Method for Climbing Drum Peel for Adhesives.
.4 ASTM D4214-07(2015), Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

.4 Canadian Standards Association (CSA).
.1 CSA S136-16, North American Specification for the Design of Cold Formed Steel Structural Members including CSA S136S1:19 Supplement 1.

.5 Green Seal Environmental Standards.
.1 Standard GC-03-1997, Anti-Corrosive Paints.
.2 Standard GS-11-2015, Architectural Paints.

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Safety Data Sheets (SDS).

1.2 DESIGN REQUIREMENTS

.1 Design exterior metal wall panel system as a “dry joint system” and to withstand live, dead, lateral, wind, seismic, handling, transportation, and erection loads, imposed and other loads.

.2 Design metal cladding to allow for thermal movement of component Materials caused by variation in ambient temperature range of 80 degrees C without causing oil canning, buckling, delamination, failure of joint seals, undue stress on fasteners or other detrimental effects.

.3 Exterior metal wall panel system to be of maximum standard size and a standardized product with no custom pieces unless panel per particular design and/or site condition requires cut to suit. Ensure products to be locally and readily available that can be easily serviced and maintained.

.4 Prevent rain penetration through wall system. Incorporate means of draining to the exterior.

.5 Design composite panel system to prevent rattling and vibration of panels, overstressing of fasteners and clips, and other detrimental effects on the

system.

.6 Panel removal: System design to allow removal of individual panels within wall system.

.7 Design miscellaneous, additional structural framing members as required to complete composite panel system, where not indicated on Contract Drawings.

.8 Maximum deviation from vertical and horizontal alignment of erected panels: 1 to 1000.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature for cladding system Materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit duplicate copies WHMIS SDS - Safety Data Sheets.

.3 Shop Drawings:
.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate dimensions and thickness of panels, fastening and anchoring methods, detail and location of joints and gaskets, thermal movement provision, wall openings, head, jamb and sill details, Materials and finish, compliance with design criteria and requirements of related Work.

.4 Samples:
.1 Submit duplicate 100 x 100 mm samples of wall and soffit system, representative of Materials, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00.
.1 Certificates: submit certificates signed by manufacturer certifying that composite wall panels comply with specified performance characteristics and physical properties.
.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.
.3 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

.6 Closeout submittals: Provide maintenance instructions for incorporation into Operation and Maintenance Manual, specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Manufacturer: company specializing in producing composite wall panels with 5 years' documented experience with sufficient capacity to produce and deliver required units without causing delay in Work.

.2 Installer: person specializing in composite wall panel installations with 5 years' documented experience and is approved by manufacturer.

.3 Mock-ups: construct mock-ups in accordance with Section 01 45 00 and to requirements supplemented as follows:
.1 Provide mock-up for evaluation of surface finishes, thermal spacer clip syst and workmanship.
.2 Provide initial production units for job-site assembly with other Materials for review.
.3 Co-ordinate type and location of mock-ups with project requirements.
.4 Accepted units will be used as standard for acceptance of production units.
.5 Remove and replace units which are not accepted.
.6 Do not proceed with remaining Work until workmanship, colour, and finish are reviewed by Departmental Representative.
.7 Refinish mock-up area as required to produce acceptable Work.
.8 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.

.4 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with Contractor's representative and Departmental Representative in accordance with Section 01 32 16 to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00.

.2 Deliver, store and protect Material in accordance with panel manufacturer's recommendations.

.3 Do not expose panels with strippable film to direct sunlight or extreme heat.

.4 Waste Management and Disposal:
.1 Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

1.6 EXTENDED WARRANTY

.1 Submit an extended warranty for composite panel Work in accordance with General Conditions, except that warranty period is extended to 3 years from date of Substantial Performance of the Work.
.1 Warrant against leaking, warping, twisting, joint, and finish failure.
.2 Coverage: Complete replacement including affected adjacent parts.

2. Manufacturer's Warranty: Provide panel manufacturer's written warranty naming Owner as beneficiary and covering failure of factory-applied exterior finish on composite metal panels within the warranty period; warrant finish per ASTM D4214 for chalk not in excess of 8 NBS units and fade not in excess of 5 NBS units. Warranty period for finish: 10 years from date Work is certified as substantially performed.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Composite panels:
.1 Thickness: 4 mm.
.2 Core: thermoplastic resin core.
.3 Bond integrity testing to adhere to ASTM D1781.
.4 Colour: refer to Exterior Finish Schedule.

.2 Aluminum face sheets:
.1 Thickness: 0.51 mm.
.2 Alloy: AA-3003.

.3 Panel weight: 5.38 kg/m².

.4 Z-girts and C channels: CSA S136; Minimum 1.2 mm thick, Z275 galvanized. Depth as indicated on Contract Drawings.

.5 Thermal spacer clip system:
.1 Thermal spacer: 100% pultruded glass fibre and thermoset polyester resin thermal spacer complete with fastener.
.2 Fasteners for spacers and attachment to back-up construction: Corrosion resistant, types as recommended by thermal spacer manufacturer.

.6 Aluminum extrusions: alloy AA-6063-T5.

.7 Flashings, closure pieces, trim: Same Material and colour as panels.

.8 Sealants: one-component, silicone base, solvent curing, colour to match panel. Maximum VOC limit 250 g/L.

.9 Accessories:
.1 Fasteners: ANSI/ASME B18.6.3, concealed, thermally broken, stainless steel Type 316, in accordance with manufacturer's recommendations.
.2 Touch-up paint: as recommended by panel manufacturer.

.3 Isolation coating: Bituminous coating, acid and alkali resistant Material.

2.2 FABRICATION

.1 Composition: two sheets of aluminum sandwiching core of extruded thermoplastic formed in continuous process with no glues or adhesives.

.2 Factory fabricated.

.3 Fabricate panels flat, true, free of marks, without visible distortion and with edges straight and true. Make all planes true, and corners square and bend of minimum radius.

.4 Tolerances:
.1 Panel bow: maximum 0.8% of panel dimension in width and length.
.2 Panel dimensions: where final dimensions cannot be established by field measurement before completion of panel manufacturing, make allowance for field adjustments as recommended by manufacturer.
.3 Panel lines, breaks and angles: sharp, true and surfaces free from warp or buckle.

2.3 PAINTED FINISHES

.1 Prefinished sheet with factory applied polyvinyl chloride.
.1 Class F2S.
.2 Colour: Refer to Exterior Finishes Schedule and Elevations for colour selections.
.3 Specular gloss: 30 units +/-5 in accordance with ASTM D523.
.4 Coating thickness: not less than 200 micrometres.
.5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822/D822M as follows:
.1 Outdoor exposure period 5000 hours.
.2 Humidity resistance exposure period 5000 hours.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Before installation examine alignment of substrate and notify Departmental Representative in writing if substrate does not comply with requirements of panel installer.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.3 INSTALLATION

.1 Install composite panels in accordance with manufacturer's written instructions and shop drawings.
.1 Allow for thermal movement.

.2 Finished Work shall be securely anchored, free of distortion, free of surface imperfections and uniform in colour.

.3 Cut and flash wall penetrations.

.4 Erect wall panels in straight lines, true, level, and plumb.

.5 Maintain following installation tolerances:
.1 Maximum variation from plane or location shown on shop drawings: 10 mm/10 m of length and up to 20 mm/100 m.
.2 Maximum deviation for vertical member: 3 mm in an 8.5 m run.
.3 Maximum deviation for a horizontal member: 3 mm in an 8.5 m run
.4 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

.6 Remove strippable coating from panels as they are erected.

.7 Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new, unless minor blemishes are approved by Departmental Representative.

.8 Thermal spacers and girts:
.1 Install thermal spacer in accordance with reviewed shop drawings and manufacturer's written instructions.
.2 Pre-drill concrete or concrete masonry unit substrate to 13 mm deeper than anticipated embedment depth of fastener into substrate.
.3 Confirm thermal clip accommodates orientation of vertical and horizontal sub-framing.
.4 Clip thermal spacer to Z-girt and fasten clip and girt to back-up structure, fastening through thermal spacer clip and into structure.
.5 Position Z-girts directly over thermal spacer before installation of fasteners.
.6 Completely install spacers, screws and sub-framing, prior to installing insulation.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus Materials, excess Materials, rubbish, tools and equipment.

.3 Leave Work areas clean, free from grease, finger marks and stains.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by composite panels installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International.
.1 ASTM D6162/D6162-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.

.2 Canadian General Standards Board (CGSB)
.1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

.3 Canadian Roofing Contractors Association (CRCA)
.1 CRCA Roofing Specifications Manual - 2020.

.4 Canadian Standards Association (CSA International)
.1 CAN/CSA-A123.4-04(R2018), Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.
.2 CSA A123.21:20, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems
.3 CSA A231.1:19/A231.2:19, Precast Concrete Paving Slabs/Precast Concrete Paving.

.5 Underwriters Laboratories' of Canada (ULC)
.1 CAN/ULC-S704.1:2017, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide two copies of most recent technical roofing components data sheets describing Materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Provide two copies of WHMIS SDS, and indicate VOC content for:
.1 Primers.
.2 Asphalt.
.3 Sealers.
.4 Adhesives.

.3 Provide shop drawings:
.1 Indicate wind uplift requirements, cover board, vapour retarder, insulation, tapered insulation, fastener layout, protection board, roof membrane, and flashing details.
.2 Provide layout for tapered insulation.

.4 Manufacturer's Certificate: certify that products meet or exceed specified requirements.

.5 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumens and membrane with specification requirements.

.6 Manufacturer's Installation Instructions: indicate special precautions required for fasteners in accordance with CSA A123.21.

.7 Manufacturer's field report: In accordance with Section 01 45 00 including but not limited to procedures followed, ambient temperatures and wind velocity during application.

1.3 QUALITY ASSURANCE

.1 Installer qualifications: company or person specializing in application of modified bituminous roofing systems approved by manufacturer.

.2 Convene pre-installation meeting two weeks prior to beginning roofing Work, with roofing Contractor's representative, room membrane manufacturer, and Departmental Representative in accordance with Section 01 32 16 to:
.1 Verify project requirements.
.2 Review wind uplift, installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

.3 Ensure torching is performed by skilled workers who have successfully completed and passed a course of instruction by membrane manufacturer in torch-applied-membrane techniques.

1.4 FIRE PROTECTION

.1 Fire Extinguishers:
.1 Maintain a minimum of one cartridge operated type or stored pressure rechargeable type with hose and shut-off nozzle,
.2 ULC labelled for A, B and C class protection.
.3 Minimum 4.5 kg on roof per torch applicator, within 6 m of torch applicator.

.2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle Materials in accordance with manufacturer's written instructions and Section 01 61 00.

.2 Storage and Handling Requirements:
.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking Materials.
.2 Provide and maintain dry, off-ground weatherproof storage.
.3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.
.4 Remove only in quantities required for same day use.

.5 Place plywood runways over completed Work to enable movement of Material and other traffic.
.6 Store sealants at +5 degrees C minimum.
.7 Store insulation protected from weather and deleterious Materials.

.3 Waste Management and disposal: remove for reuse and return by manufacturer of pallets, crates, padding and packaging Materials in accordance with Section 01 74 20.
.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
.2 Fold up metal banding, flatten and place in designated area for recycling.
.3 Place Materials defined as hazardous or toxic in designated containers.
.4 Handle and dispose of hazardous or toxic Materials in accordance with Authorities having jurisdiction.

1.6 FIELD CONDITIONS

.1 Ambient Conditions
.1 Do not install roofing when temperature remains below -18°C for torch application, or to manufacturers' recommendations for mop application.
.2 Minimum temperature for solvent-based adhesive is -5 degrees C.

.2 Install roofing on dry deck, free of snow and ice, use only dry Materials and apply only during weather that will not introduce moisture into roofing system.

1.7 WARRANTY

.1 For Work of this Section 07 52 00 - Modified Bituminous Membrane Roofing, 12 months warranty period is extended to 60 months.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration to Departmental Representative stating that Materials and components, as assembled in system, meet this requirement.

.2 Roofing System: Design to CSA A123.21 for wind uplift resistance.

2.2 EXISTING MEMBRANE COVER BOARD AND VAPOUR RETARDER

.1 Composite cover board consisting of a SBS modified bituminous membrane with a non-woven polyester reinforcement, self-adhesive selvedge edge, and sanded top surface laminated to a high density rock wool board having the following minimum criteria.
.1 Total thickness: 18 mm.
.2 Membrane thickness: 2.2 mm.
.3 weight: 2.6 kg/m^2.
.4 Tear strength: 60N.

.5 Static puncture resistance: 400N.
.6 Water vapour permeance: maximum 0.21 ng/Pa•s•m^2.

2.3 COVER BOARD FASTENER

.1 Type as recommended by roof system manufacturer to meet wind uplift requirements.

2.4 DECK PRIMER

.1 Asphalt primer: to CGSB 37-GP-9Ma, manufacturer's low VOC primer.

2.5 VAPOUR RETARDER

.1 Self adhesive air/vapour barrier: Minimum 0.8 mm thick self adhesive membrane consisting of SBS modified bitumen adhesive bottom and tri-laminated woven polyethylene top with silicone release film having the following minimum criteria.
.1 Tensile strength (MD): 9.5 kN/m.
.2 Ultimate elongation (MD): 33%.
.3 Water absorption: 0.1%.
.4 Tear resistance (MD): 95N.
.5 Static puncture (MD): 400N.
.6 Air permeability: maximum 0.001 L/s•m^2.
.7 Water vapour permeance: maximum 1.7 ng/Pa•s•m^2.

2.6 POLYISOCYANURATE INSULATION

.1 To CAN/ULC-S704.1, Type II, organic facers, flame spread less than 100, density 32 kg/m^3,compressive strength 138 kPa, linear dimensional stablility less than 2%, tensile strength 35 kPa, thickness as indicated.

2.7 POLYISOCYANURATE TAPERED INSULATION

.1 To CAN/ULC-S704.1, Type II, organic facers, flame spread less than 100, density 32 kg/m^3,compressive strength 138 kPa, linear dimensional stablility less than 2%, tensile strength 35 kPa, slopes as indicated but not less than 1%.

2.8 INSULATION FASTENERS

.1 Corrosion resistant insulation fasteners and galvanized plates meeting CSA requirements for wind uplift as recommended by insulation manufacturer.

2.9 OVERLAY BOARD

.1 Overlay Board: 6 mm thick asphalt based recovery board with non-woven glass facers, as recommended by the membrane manufacturer.

2.10 CANT STRIPS

.1 Cut from rigid mineral wool fibre Material, to measure 140 mm on slope.

2.11 ADHESIVE

.1 Adhesive for securing overlay board and cant: asphalt extended vulcanized adhesive, two component unit, consisting of two liquids mixed on site to produce pourable adhesive.

2.12 MEMBRANES

.1 Base sheet and base flashings: Combination of polyester and glass fibres to ASTM D6162/D6162M.
- .1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer prefabricated sheet, composite reinforcement, having nominal weight of 200 g/m².
- .2 Type 1, fully adhered.
- .3 Grade S.
- .4 Bottom and top surfaces: sanded/polyethylene.

.2 Cap sheet and cap flashings: Combination of polyester and glass fibres to ASTM D6162/D6162M.
- .1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer prefabricated sheet, composite reinforcement, having nominal weight of 200 g/m².
- .2 Type 1, fully adhered.
- .3 Grade S.
- .4 Bottom and top surface: polyethylene/granules. Colour and solar reflectance index: refer to Exterior Finish Schedule.

2.13 BITUMEN

.1 Asphalt: to CAN/CSA-A123.4.
- .1 Type 2 for slopes up to 1:8.
- .2 Type 3 for slopes from 1:8 to 1:4.

2.14 SEALERS

.1 Plastic cement: asphalt.

.2 Sealing compound: rubber asphalt type.

.3 Sealants: as recommended by membrane system manufacturer.

2.15 RETROFIT DRAINS

.1 Leader size to match existing, vandal proof cast aluminum dome with hinged access gate clamped directly to drain body, 2.3 mm pan-formed aluminum drain body, deck flange and straight aluminum outlet, 9 mm aluminum bolts welded to drain complete with cast aluminum stabilizer ring, aluminum sediment collar and aluminum flow control, EPDM sealing ring, and bituminous painted deck flange.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for roofing installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 QUALITY OF WORK

.1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual and CRCA Roofing Specification Manual, and Provincial Roofing Association Manual.

.2 Do priming in accordance with manufacturers written recommendations.

.3 The interface of the walls and roof assemblies will be fitted with durable rigid Material providing connection point for continuity of air barrier.

.4 Assembly, component and Material connections will be made in consideration of appropriate design loads.

3.3 REMOVAL OF EXISTING ROOF AND FLASHINGS

.1 Where sections of roof are to be removed completely or just ballast removed for subsequent Work, remove gravel and pavers to expose membrane. Where indicated, cut back minimum of 230 mm outside line of opening or removal area to facilitate future flashing.

.2 Remove metal counter flashings to permit access to top edge of base flashings.

.3 For complete roof removal, remove roof system including but not limited to ballast, membrane, flashings, cants, insulation, vapour retarder, fasteners, over area to be removed.

.4 Provide areas where roof system or just ballast has been removed ready for subsequent roofing Work.

.5 Ensure substrates and remaining roof memebrane where existing roof system has been removed are clean, water tight, and ready for subsequent roofing Work.

.6 At locations where items are removed and a hole in the deck remains. Provide new deck to match existing and fill in area with insulation to provide a smooth surface for subsequent roofing Work.

.7 Remove sheet metal flashings indicated on drawings.

.8 Remove waste roof and sheet metal elements from Site in accordance with Section 02 41 19.

3.4 EXAMINATION OF ROOF DECKS

.1 Verification of Conditions: Inspect with Departmental Representative deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.

.2 Evaluation and Assessment:

.1 Prior to beginning of Work ensure:

.1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.

.2 Curbs have been built.

.3 Roof drains have been installed at proper elevations relative to finished roof surface.

.4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.3 Do not install roofing Materials during rain or snowfall.

3.5 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover walls, and adjacent Work where Materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous Material immediately.

.4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Departmental Representative.

.6 At end of each day's Work or when stoppage occurs due to inclement weather, provide protection for completed Work and Materials out of storage.

.7 Metal connectors and decking will be treated with rust proofing or galvanization.

3.6 COVER BOARD

.1 Mechanically fasten cover board to deck with reversible mechanical attachments in accordance with manufacturer’s written instructions and to meet wind uplift requirements.

.2 Place in longest boards possible with end joints staggered and fully supported.

3.7 PRIMING DECK

.1 Apply deck primer to deck and roofing substrate at the rate recommended by manufacturer.

3.8 VAPOUR RETARDER

.1 Install vapour retarder in accordance with manufacturers written instructions.

.2 Lap vapour retarder ends and edges 50 mm minimum. Roll vapour retarder and laps for continuous adhesion over entire substrate area; use manufacturer's recommended roller.

.3 Cut and fit vapour retarder as required for passage of protrusions, ensuring continuous adherence to substrate.

.4 At junction of deck to vertical surfaces and along perimeter of roof deck, extend vapour retarder, set in adhesive, beyond the point where insulation will terminate.

.5 Seal penetrations, end and side laps, and ends of vapour retarder to substrates and to wall system air/vapour retarder to maintain continuity of building air/vapour retarder system.

3.9 MEMBRANE ROOFING APPLICATION

.1 Insulation: mechanically fastened application:
.1 Mechanically fasten insulation using screws and pressure distribution plates.
.2 Fasten insulation as per manufacturer's written recommendations and to wind uplift requirements.
.3 Place boards in parallel rows with ends staggered, and in firm contact with one another.
.4 Cut end boards to suit.

.2 Tapered insulation application:
.1 Mop insulation to top layer of insulation with hot asphalt at rate of 1 kg/m^2.
.2 Install tapered insulation in accordance with shop drawings. Stagger joints between layers 150 mm minimum.

.3 Overlay Board: adhesive application:
.1 Adhere overlay board to insulation with vulcanized adhesive at the rate of one litre per m^2.
.2 Place boards in parallel rows with end joints staggered. Cap joints approximately 25 mm.
.3 Cut ends to suit and apply adhesive in continuous ribbons at 300 mm on centre.

.4 Base sheet application:
.1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and reroll from both ends.
.2 Unroll and embed base sheet in uniform coating of asphalt applied at rate of 1.2 kg/m², at 230 degrees C.
.3 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.
.4 Application to be free of blisters, wrinkles and fishmouths.

.5 Cap sheet application:
.1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.
.2 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.
.3 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.
.4 Application to be free of blisters, fishmouths and wrinkles.
.5 Do membrane application in accordance with manufacturer's recommendations.

.6 Flashings:
.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.
.2 Mop base sheet and torch cap sheet onto substrate in 1 metre wide strips.
.3 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by mopping.
.4 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.
.5 Provide 75 mm minimum side lap and seal.
.6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.
.7 Do Work in accordance with manufacturer's recommendations.

.7 Roof penetrations:
.1 Install roof drain pans, roof drains, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

3.11 FIELD QUALITY CONTROL

.1 Inspections:
.1 Inspection and testing of roofing application will be carried out by testing laboratory designated by Departmental Representative.
.2 Departmental Representative will pay for tests as specified in Section 01 45 00.

3.12 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20. Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
.1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM C920-18, Specification for Elastomeric Joint Sealants.
.3 ASTM D523-14(2018), Standard Test Method for Specular Gloss.
.4 ASTM D2244-16, Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
.5 ASTM D4214-07(2015), Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

.3 Canadian Standards Association (CSA International)
.1 CSA S136-16 Package, North American Specification for the Design of Cold Formed Steel Structural Members including CSA S136S1:19 Supplement 1.

1.2 SUBMITTALS

.1 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures and wind uplift requirements.

.2 Submit product data in accordance with Section 01 33 00.

.3 Submit product data sheets for waterproofing membrane, insulation, roof supports, roof panels, and accessories. Include:
.1 Product characteristics.
.2 Performance criteria.
.3 Limitations.

.4 Submit shop drawings in accordance with Section 01 33 00 indicating.
.1 Arrangements of sheets and joints, materials, thicknesses, dimensions, layouts, wind uplift requirements, types and locations of supports and fasteners and special shapes.
.2 Relationship of panels to structural frame.
.3 Relationship and details of PV panels on metal roof system and metal roof framing and support system including all penetrations and connections to or through roof system.
.4 Details of waterproofing membrane, insulation, connections, and all other components in the system.

.5 Submit samples in accordance with Section 01 33 00. Submit duplicate 300 x 300 mm samples of each sheet metal material.

1.3 QUALITY ASSURANCE

.1 Retain a Professional Engineer, licensed in Province of Ontario, with experience in metal roofing work of comparable complexity and scope to perform following services as part of work of this Section:
.1 Design of metal roof system and PV attachment system in accordance with Performance Criteria and details indicated.
.2 Review, stamp, and sign shop drawings.
.3 Conduct shop and on-Site inspections and prepare and submit inspection reports.

.2 Mock-up:
.1 Submit mock-ups in accordance with Section 01 45 00.
.2 Fabricate 1200 x 1200 mm sample roofing panel for each roof system using identical project materials and methods to include typical seam.
.3 Mock-up will be used: To judge quality and workmanship, substrate preparation, and material application.
.4 Locate where directed.
.5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with roofing work.
.6 When accepted, mock-up will demonstrate minimum standard of quality and workmanship required for this Work. Approved mock-up may remain as part of finished Work.

.3 Convene pre-installation meeting two weeks prior to beginning roofing Work, with roofing Contractor's representative, room panel manufacturer, and Departmental Representative in accordance with Section 01 32 16 to:
.1 Verify project requirements.
.2 Review wind uplift, installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00.

.2 Storage and Handling Requirements:
.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
.2 Provide and maintain dry, off-ground weatherproof storage.
.3 Remove only in quantities required for same day use.
.4 Store sealants at +5 degrees C minimum.
.5 Store insulation protected from weather and deleterious materials.

.3 Waste Management and disposal: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.
.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
.2 Fold up metal banding, flatten and place in designated area for

recycling.
.3 Place materials defined as hazardous or toxic in designated containers.
.4 Handle and dispose of hazardous or toxic materials in accordance with Authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration to Departmental Representative stating that materials and components, as assembled in system, meet this requirement.

.2 Design roofing elements to withstand live, dead, lateral, wind, seismic, handling, transportation and erection loads.

.3 Design metal roofing elements in accordance with following Climatic Design Data for Port Weller contained in National Building Code:
.1 Design temperature: January 1%, July 2-1/2%.
.2 Wind (Hourly wind pressures): 1 in 50 year occurrence.
.3 Earthquake: Seismic Data as listed.

.4 Design metal roofing system to limit deflection under design loads to 360.

.5 Design metal roofing system to prevent restriction of thermal induced movement which would induce deformation such as warping, buckling, and failure of joint seals and fasteners.

.6 Design metal roofing system to prevent the infiltration of water into the roof system and to prevent roofing system components from vibrating due to design wind loads.

.7 Design metal roof system to accommodate installation of PV panels.

2.2 SHEET METAL MATERIALS

.1 Sheet steel: Zinc coated steel sheet to ASTM A653/A653M, prefinished commercial quality, with Z275 zinc coating, extra smooth surface, 0.6 mm minimum base metal thickness.

2.3 PREFINISHED STEEL SHEET

.1 Prefinished sheet steel with factory applied polyvinylidene fluoride.
.1 Class F2S.
.2 Colour selected by Departmental Representative from manufacturer's custom standard range.
.3 Specular gloss: 30 units +/-5 to ASTM D523.
.4 Coating thickness: not less than 22 micrometres.
.5 Resistance to accelerated weathering: Will not chalk in excess of a number 8 in accordance with ASTM D4214 method D659.
.6 Will not change colour more than five (5.0) Hunter ΔE units as

determined by ASTM D2244.

.2 Fascia, trim, closure, and flashings: Material, finish, colour, fasteners and thickness to match metal roofing material.

2.4 WATERPROOF/ UNDERLAYMENT MEMBRANE

.1 Waterproof membrane: Minimum 1.0 mm thick, self-adhesive high temperature membrane consisting of SBS modified bitumen adhesive bottom and tri-laminated woven polyethylene top with silicone release film having the following minimum criteria.
- .1 Breaking strength (MD): 10.7 kN/m.
- .2 Elongation at Break (MD): 16%.
- .3 Tear resistance (MD): 400N.
- .4 Static puncture: 140N.
- .5 Water vapour permeance: 1.2 ng/Pa•s•m^2.

2.5 INSULATION

.1 Insulation: ASTM C553, 32 kg/m3, mineral wool blanket. Thickness as indicated and having the following minimum criteria.
- .1 Flame spread: 0.
- .2 Smoke developed: 0.
- .3 RSI/25 mm: 0.70 m^2K/W.
- .4 Moisture absorption: 0.03%

2.6 GIRTS, CHANNELS AND CLIPS

.1 Sub-girts, Z girts and C channels: CSA S136 and CSA S136S1; Minimum 1.2 mm, Z275 galvanized Z girts and C channels. Depth: As indicated.

.2 Seam clips: ASTM A653/A653M; Z275 galvanized steel, thermal clip system.

2.7 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Sealant: ASTM C920, Type S, Grade NS, Class 25; High-performance, medium-modulus, one-part, neutral-cure silicone sealant. Colour to match roofing finish colour.

.3 Manufactured ridge profile for top of gable.

.4 Fasteners: Concealed, screw type, ANSI B18.6.4, stainless steel Type 304. In location where exposed fasteners have to be used, fasteners to be complete with coloured heads to match metal roofing.

.5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.6 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.8 FABRICATION

.1 Fabricate roof components in accordance with reviewed shop drawings factory-ready for field installation.

.2 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.

.3 Fabricate metal roofing panels square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.4 Notch Z girts and C channels as required to allow for drainage of rain screen cavity.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Departmental Representative. Commencement of work of this Section means acceptance of existing conditions.

3.2 WATERPROOF MEMBRANE

.1 Install primer and waterproof membrane continuously over deck, in accordance with manufacturer's instructions.

.2 Overlap waterproof membrane 50 mm along sidelaps and 75 mm on end laps and lap in direction of waterflow.

3.3 GIRTS AND CHANNELS

.1 Install Z girts, fastened through waterproof membrane and into structural framing beneath. Orient Z girts to drain water from rainscreen cavity.

.2 Frame roofing system edges, with C channels and orient channel webs to face outwards.

3.4 INSULATION

.1 Prior to installation of insulation, examine waterproofing membrane and make good damage.

.2 Install metal roof insulation in continuous contact with waterproof membrane and fitted between Z girts and C channels. Butt boards together with no spaces between boards. Areas of insulation system having voids will be rejected.

.3 When cutting insulation board, cut completely though board thickness and trim to provide plain but joints. Do not break or tear insulation board to fit detail.

3.5 FASCIA, TRIM, CLOSURES, AND FLASHINGS

.1 Form and profile fascia and trim including inside and outside corners, flashing, edgings, cap strips, drips, fillers, closure strips, and starter strips in accordance with the drawings.

.2 Flashings to utilize an "S" locking joint for concealed fastening.

.3 Cut neat holes in metal roofing to accommodate roof penetrations and install flashing for a watertight installation.

3.6 METAL ROOF INSTALLATION

.1 Install metal roofing in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Use concealed fastenings except where approved by Departmental Representative before installation.

.3 Install seam clips spaced as indicated on reviewed shop drawings to comply with design criteria. Secure cleats with two fasteners each minimum, into Z girts or metal deck.

.4 Fold lower end of each panel 19 mm to underside, and upper end of each panel 50 mm onto topside. Slit fold 25 mm away from corner to form tab where panel turns up to make standing seam. Interlock lower and upper ends of panels.

.5 Apply sheet metal roofing beginning at eaves. Loose lock pans to valley flashing and edge strips at eaves and gable rakes.

.6 Install standing seams complete with snap on caps in accordance with reviewed shop drawings.

.7 Install metal roofing panels in one piece, for entire slope, except as indicated otherwise. In locations that roof panels cannot be installed in one piece, provide 100 mm starter strip to join the panels together. Provide a continuous sealant bead under starter strip.

.8 Metal roof panels terminating at eaves or valleys shall not have a raw metal edge or exposed fasteners. Fold panel ends and install in accordance with reviewed shop drawings

.9 Insert metal roof panels terminating at hips or ridges into concealed metal closures. Metal closures shall allow for expansion of the metal roof panel and also act as a starter strip for hip or ridge flashings.

.10 Install valley sheets not exceeding 3 m in length. Shingle lap joints 150 mm in direction of flow. Extend valley sheet minimum 150 mm under roofing sheets. Double fold valley and roofing sheets and secure at 450 mm oc.

.11 Apply isolation coating to metal surfaces in contact with concrete or mortar.

.12 Remove and replace damaged metal roofing. Do not touch-up damaged panels.

.13 Seal where necessary to form weathertight seal between flashing and adjoining surfaces and between flashing and other work. Sealing work consists of bedding between members where possible. Tool sealant to concave profile where exposed.

.14 Clean exposed finished surfaces of complete installation free of dirt, grease and smudges. Touch-up scratches with air dry formulation of coating system to match original factory finish.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
.1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM C920-18, Specification for Elastomeric Joint Sealants.
.3 ASTM D523-14(2018), Standard Test Method for Specular Gloss.
.4 ASTM D822/D822M-13(2018), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian Roofing Contractors Association (CRCA)
.1 Roofing Specifications Manual - 2020.

.3 Canadian Standards Association (CSA International)
.1 CSA A123.3-05(R2020), Asphalt Saturated Organic Roofing Felt.
.3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature for sheet metal flashing systems Materials, wind uplift requirements, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies WHMIS SDS - Safety Data Sheets.

.3 Shop Drawings:
.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.4 Samples:
.1 Submit duplicate 50 x 50 mm samples of each type of sheet metal Material, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00.
.1 Manufacturer's Instructions: submit manufacturer's installation instructions, wind uplift requirements, and special handling criteria, installation sequence, and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Pre-Installation Meeting: convene pre-installation meeting two weeks prior to beginning on-site installation, with contractor's representative and Departmental Representative in accordance with Section 01 32 16 to:
.1 Verify project and wind uplift requirements.
.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal:
.1 Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: 0.60 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

2.2 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied polyvinylidene fluoride.
.1 Class F2S.
.2 Colour selected by Departmental Representative from manufacturer's full colour range.
.3 Specular gloss: 30 units +/- in accordance with ASTM D523.
.4 Coating thickness: not less than 22 micrometres.
.5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822/D822M as follows:
.1 Outdoor exposure period 2500 hours.
.2 Humidity resistance exposure period 5000 hours.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB-37.5.

.3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.

.4 Sealants: ASTM C920, Type S, Grade NS, Class 25, SWRI validated; High-performance, medium-modulus, one-part, neutral-cure silicone sealant. Colour to match flashing finish colour.

.5 Cleats: of same Material, and temper as sheet metal, minimum 50 mm wide. Thickness 1.2 mm.

.6 Fasteners: of same Material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.7 Washers: of same Material as sheet metal, 1 mm thick with rubber packings.

.8 Touch-up paint: as recommended by prefinished Material manufacturer.

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal Work in accordance with applicable CRCA 'FL' series details.

.3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.4 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.6 mm thick prefinished sheet steel.

2.6 REGLETS AND CAP FLASHINGS

.1 Form recessed reglets and metal cap flashing of 0.6 mm thick in accordance with CRCA FL series details for each specific roof assemblies as indicated on Drawings and specified herein.
.1 Provide slotted fixing holes and steel/plastic washer fasteners.
.2 Cover face and ends with plastic tape.

2.7 EAVES TROUGHS AND DOWNPIPES

.1 Form eaves troughs and downpipes from 0.6 mm thick prefinished sheet metal.

.2 Sizes and profiles as indicated.

.3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

2.9 SCUPPERS

.1 Form scuppers from 0.6 mm thick sheet metal. Sizes and profiles as indicated.

.3 Provide necessary fastenings.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install sheet metal Work in accordance with CRCA FL series details and as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
.1 Flash joints using S-lock seams forming tight fit over cleat strips and as detailed.

.5 Lock end joints and caulk with sealant.

.6 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.

.7 Caulk flashing at reglet and cap flashing with sealant.

3.3 EAVES TROUGHS AND DOWNPIPES

.1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough screws through spacer ferrules. Slope eaves troughs to downpipes as indicated.

.2 Install downpipes and provide goosenecks back to wall. Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.

3.4 SCUPPERS

.1 Install scuppers as indicated.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus Materials, excess Materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S101-14, Standard Methods of for Fire Endurance Tests of Building Construction and Materials.
.2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.3 CAN/ULC-S115-18, Standard Method of Fire Tests of Firestop Systems.

1.2 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or Materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop Material that has Listed Systems Design and is used individually without use of high temperature insulation or other Materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop Materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Continuity of Fire Separations: NBC 2015, Division B, Parts 3.1.8, 3.1.9.1, and 9.10.9:
.1 Wall, partition or floor assemblies required to be a fire separation shall be: constructed as a continuous element; have a fire resistance rating; have openings protected by a closure; and have penetrations sealed by a firestop.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS SDS - Safety Data Sheets for each proposed product.

.3 Shop Drawings:
.1 Submit shop drawings to show locations, proposed Materials, reinforcement, anchorage, fastenings and method of installation.
.2 Construction details should accurately reflect actual job conditions.

.4 Quality assurance submittals: submit following in accordance with Section 01 45 00.
.1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
.2 Certificates: submit certificates signed by manufacturer certifying that Materials comply with specified performance characteristics and physical properties.
.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company specializing in fire stopping installations approved by manufacturer.
.2 All fire stopping Material shall be from one manufacturer.
.3 All fire stopping installation work for entire project shall be by a single Contractor experienced in firestopping. Individual disciplines shall NOT fire stop their own work.

.2 Pre-Installation Meetings: convene pre-installation meeting two weeks prior to beginning work of this Section with Contractor's representative and Departmental Representative in accordance with Section 01 32 16 to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's and ULC installation instructions and warranty requirements.

.3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
.2 Two times during progress of Work at 50% and 75% complete.
.3 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle Materials in accordance with Section 01 61 00.
.2 Deliver, store and handle Materials in accordance with manufacturer's written instructions.

.3 Deliver Materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

.2 Storage and Protection:
.1 Store Materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Replace defective or damaged Materials with new.

.3 Waste Management and Disposal: Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.
.1 Asbestos-free Materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
.2 Fire stop system rating: F and FT.

.2 Service penetration assemblies: systems tested to CAN/ULC-S115.

.3 Service penetration fire stop components: certified by test laboratory to CAN/ULC-S115.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific Material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup Materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of Materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping Materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

.1 Install fire stopping and smoke seal Material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after Materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

.2 Install floor fire stopping before interior partition erections.

.3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.

.4 Mechanical pipe insulation: certified fire stop system component.
.1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

.1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping Materials and service penetration assemblies.

.2 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus Materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal Materials.

3.7 SCHEDULE

.1 Fire stop and smoke seal at:
.1 Penetrations through fire-resistance rated walls.
.3 Top of fire-resistance rated partitions.
.4 Intersection of fire-resistance rated partitions.
.5 Control and sway joints in fire-resistance rated partitions and walls.
.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
.7 Openings and sleeves installed for future use through fire separations.
.8 Around mechanical and electrical assemblies penetrating fire separations.
.9 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping Material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials, preparation and application for caulking and sealants.

.2 Text to complete other various Sections containing sealant or caulking specifications.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM C834-17, Standard Specification for Latex Sealants.
- .2 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .2 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.4 Transport Canada (TC)
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00.

.2 Manufacturer's product to describe.
- .1 Caulking compound.
- .2 Primers.
- .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit samples in accordance with Section 01 33 00.

.4 Submit duplicate samples of each type of Material and colour.

.5 Cured samples of exposed sealants for each color where required to match adjacent Material.

.6 Submit manufacturer's instructions in accordance with Section 01 33 00.
- .1 Instructions to include installation instructions for each product used.

1.4 QUALITY ASSURANCE/MOCK-UP

.1 Construct mock-up in accordance with Section 01 45 00.

.2 Construct mock-up to show location, size, shape and depth of joints complete with back-up Material, primer, caulking and sealant.

.3 Mock-up will be used: To judge workmanship, substrate preparation, operation of equipment and Material application.

.4 Locate where directed.

.5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sealant Work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect Materials in accordance with Section 01 61 00.

.2 Deliver and store Materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging Materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging Material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Place Materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous Materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Unused sealant Material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing Material from landfill to official hazardous Material collections site approved by Departmental Representative.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic Materials destined for recycling.

.9 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 PROJECT CONDITIONS

.1 Environmental Limitations:
.1 Do not proceed with installation of joint sealants under following conditions:
.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4°C.
.2 When joint substrates are wet.

.2 Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous Materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Silicones One Part:
.1 Type A: Primerless To ASTM C920, Type S, Grade NS, Class 50, SWRI validated.
.2 Type B: Mildew resistant, primerless to CAN/CGSB-19.22 or ASTM C920, Type S, Grade NS, Class 25.

.2 Acrylic Latex One Part (Type C): Primerless to CAN/CGSB-19.17 or ASTM C834, Type OP, Grade -18 deg. C, Class 12.5.

.3 Acoustical Sealant. Primerless, to ASTM C920, Type S, Grade NS, Class 25, SWRI validated.

.4 Preformed Compressible and Non-Compressible back-up Materials:
.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
.1 Extruded open or closed cell foam backer rod.
.2 Size: oversize 30 to 50%.
.2 Bond Breaker Tape: Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): Type A.

.2 Expansion and control joints in exterior surfaces of masonry and poured-in-place concrete walls: Type A.

.3 Horizontal expansion joint at junction between new and existing buildings at concrete floor slab and roof: Type A.

.4 Vertical expansion joint at exterior wall junctions between existing concrete wall and new steel stud wall with composite wall panel: Type A.

.5 Coping joints and coping-to facade joints: Type A.

.6 Cornice and wash (or horizontal surface joints): Type A.

.7 Seal interior perimeters of exterior openings as detailed on drawings: Type C.

.8 Control and expansion joints on the interior of masonry and exterior poured-in place concrete walls: Type A.

.9 Interior control and expansion joints in floor surfaces: Type A.

.10 Perimeters of interior frames, as detailed and itemized: Type C.

.11 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Type C.

.12 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Type C.

.13 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Type B.

.14 Exposed interior control joints in drywall: Type C.

.15 Cover plate at floor and interior side of drywall: Type C.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming Materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup Materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of Materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix Materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant.
.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
.3 Apply sealant in continuous beads.
.4 Apply sealant using gun with proper size nozzle.
.5 Use sufficient pressure to fill voids and joints solid.
.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
.7 Tool exposed surfaces before skinning begins to give slightly concave shape.
.8 Remove excess compound promptly as Work progresses and upon completion.

.2 Curing.
.1 Cure sealants in accordance with sealant manufacturer's instructions.
.2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup.
.1 Clean adjacent surfaces immediately and leave Work neat and clean.
.2 Remove excess and droppings, using recommended cleaners as Work progresses.
.3 Remove masking tape after initial set of sealant.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
.1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)
.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)
.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
.2 CSDMA, Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.5 National Fire Protection Association (NFPA)
.1 NFPA 80-2019, Standard for Fire Doors and Other Opening Protectives.
.2 NFPA 252-2017, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)
.1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
.2 CAN/ULC-S702.1-14(R2019), Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
.3 CAN/ULC-S704.1-17, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:
.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 and NFPA 252 for ratings specified or indicated.
.4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC-S104 and NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Provide product data: in accordance with Section 01 33 00.

.3 Provide shop drawings: in accordance with Section 01 33 00.
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed screen, arrangement of hardware and fire rating and finishes.
.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, fiberglass screen retainers, location of anchors and exposed fastenings, reinforcements, fire rating, and finishes.
.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.4 Provide samples in accordance with Section 01 33 00.

.5 Submit one 300 x 300 mm corner sample of each type of door and frame.
.1 Show butt cutout, glazing stops, screen securement, and snap-on trim with clips.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal: Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653/A653M, Z275, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts, minimum 30% recycled content.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653/A653M, Z275, minimum 30% recycled content.

2.2 DOOR CORE MATERIALS

.1 Stiffened: face sheets laminated to polyurethane core and steel stiffened for insulated and fire rated cores.

.2 Interior doors: Mineral fiber to CAN/ULC-S702.1, semi-rigid, 24 kg/m^3.

.3 Exterior doors: Polyurethane: to CAN/ULC-S704.1 rigid, closed cell board, density 32 kg/m^3.

.4 Fire rated doors: Mineral fiber to CAN/ULC-S702.1, Type 1A; 24 kg/m3

2.3 ADHESIVES

.1 Polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Section 09 91 00. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate glazing stops and fiberglass screen retainers as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal riveted.

.6 Sealant: in accordance with Section 07 92 00.

.7 Glazing: in accordance with Section 08 80 00.

.8 Fiberglass mesh: heavy duty, fine fiberglass mesh. Provide samples for Departmental Representative’s approval.

.9 Weatherstripping: Manufacturer's standard heavy duty, durable, non-absorbing material resistant to deterioration by aging and weathering.

.10 Make provisions for glazing and fiberglass screens as indicated and provide necessary glazing stops and retainers.
.1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk tamperproof stainless steel screws.
.2 Provide removable stainless steel retention system to retain fiberglass screen. Secure retention system with countersunk tamperproof stainless steel screws.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm, welded, thermally broken type construction.

.4 Interior frames: 1.6 mm, welded, type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by Finish Hardware Supplier. Reinforce frames for surface mounted hardware.

.6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.7 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: hollow steel construction. Interior doors: hollow steel construction.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC-S104 and NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.10 Manufacturer's nameplates on doors are not permitted.

2.11 HOLLOW STEEL CONSTRUCTION

.1 Form face sheets for exterior doors from 1.6 mm sheet steel.

.2 Form face sheets for interior doors from 1.6 sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.

.4 Fill voids between stiffeners of exterior doors with polyurethane core.

.5 Fill voids between stiffeners of interior doors with mineral wool core.

2.12 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 11.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
- .1 Hinge side: 1.0 mm.
- .2 Latchside and head: 1.5 mm.
- .3 Finished floor, noncombustible sill and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 00.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Architectural Manufacturers Association (AAMA)
.1 AAMA 609/610-15, Cleaning and Maintenance Guide for Architecturally Finished Aluminum.
.2 AAMA 2605-20, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels - Series: Components, Coatings and Finishes.
.3 AAMA CW-10-2012, Care and Handling of Architectural Aluminum From Shop to Site.
.4 AAMA CW-DG-1-96, Aluminum Curtain Wall Design Guide Manual.

.2 ASTM International
.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM B209M-14, Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
.3 ASTM B221M-13, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
.4 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.
.5 ASTM C1363-19, Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
.6 ASTM E283/E283M-19, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
.7 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.
.8 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-12.1-2017, Tempered or Laminated Safety Glass.
.2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.

.4 CSA International
.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA S157-17/S157.1-17, Strength Design in Aluminum/Commentary on CSA S157-17, Strength Design in Aluminum.

.5 Underwriter’s Laboratories of Canada (ULC):
.1 CAN/ULC-S710.1:2019, Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for doors and frames and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate Materials and profiles and provide full-size, scaled details of components for each type of door and frame. Indicate:
.1 Interior trim and exterior junctions with adjacent construction.
.2 Junctions between combination units.
.3 Elevations, dimensions, framed opening requirements.
.4 Frame Material, core thicknesses of components, reinforcements, glazing stops, tolerances.
.5 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.
.6 Location of sealant.
.7 Each type of door system including location.
.8 Track profile, Material, and dimensions.
.9 Arrangement of reinforcing for hardware and joints.
.10 Arrangement of hardware and required clearances.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into Work.
.3 Submit one 300 x 300 mm corner sample of each type door frame and finish.
.4 Submit one 300 x 300 mm sample of insulating glass unit showing glazing detail, edge and corner details, and finish.
.5 Frame sample to show glazing stop, door stop, reinforcement, jointing detail, finish, wall trim.

.5 Manufacturers Reports:
.1 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in Part 3 - FIELD QUALITY CONTROL.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for cleaning and maintenance of doors and finishes for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Certifications: product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00, manufacturer's written instructions, and AAMA CW-10.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.
.1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Use coatings that are easy to remove and residue free.
.2 Leave protective covering in place until final cleaning of building.

.3 Storage and Handling Requirements:
.1 Store Materials off ground under cover in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect aluminum doors and frames from nicks, scratches, and blemishes.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.6 EXTENDED WARRANTY

.1 Submit an extended warranty for aluminum doors and frame Work in accordance with General Conditions, except that warranty period is extended to five (5) years.
.1 Warrant against failure to meet the design criteria and requirements such as interior leakage, insulating glass unit failure, finish degradation, frame condensation.
.2 Coverage: Complete replacement including affected adjacent Work.

PART 2 - PRODUCTS

2.1 SYSTEMS DESCRIPTION

.1 Provide aluminum-framed, thermally broken swing door with glass insert suitable for inclusion in curtain wall or within wall framing system

.2 Provide 2 panel aluminum-framed, thermally broken insert patio door system with glass insert suitable for inclusion in curtain wall system.

2.2 DESIGN CRITERIA

.1 Design frames and doors to:
.1 Accommodate expansion and contraction within service temperature range of -35 to 35 degrees C.
.2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E330/E330M under wind load of 1.2 kPa in accordance with ASTM E330/E330M. submit certificate of tests performed substrate.
.3 Air infiltration: 0.3 L/s/m2 maximum of wall area to ASTM E283/E283M at differential pressure across assembly of 300 Pa.
.4 Water infiltration: None to ASTM E331 at differential pressure across assembly of 390 Pa.
.5 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.
.6 Movement within system.
.7 Movement between system and perimeter framing components or substrate.

.2 Design door system to provide thermal conductivity of:
.1 Door system (including vision glass areas): ASTM C1363, USI-2.2 maximum.
.2 Vision glass areas: Centre-of-glass USI-1.42, SHGC 0.4 maximum, VLT 0.7.

.3 Design aluminum doors and frames to AAMA CW-DG-1.

.4 Design aluminum components to CSA S157/S157.1.

.5 Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.

.6 Include continuous air/vapour retarder through door system. Primarily in line with inside pane of glass and heel bead of glazing compound.

2.3 MATERIALS

.1 Aluminum extrusions: to Aluminum Association alloy AA 6063-T5 or T6 as required by design, anodizing quality.

.2 Sheet aluminum: to ASTM B209M, anodizing quality.

.3 Thermal break: To AAMA IIR-A8, glass fibre reinforced polyamide porthole extrusion.

.4 Steel reinforcement: to CSA G40.20/G40.21, grade 300W.

.5 Fasteners: stainless steel, finished to match adjacent Material.

.6 Weatherstrip: replaceable, metal backed wool pile.

.7 Door bumpers: black neoprene.

.8 Door bottom seal: adjustable door seal of extruded aluminum frame and vinyl weather seal, surface mounted with drip cap, closed ends.

.9 Isolation coating: alkali resistant bituminous paint.

.10 Glass and glazing: in accordance with Section 08 80 00.

.11 Sliding door track:
.1 Top, Bottom, and side track: Recess mounted, extruded aluminum dual track profile: To ASTM B221M, 6063 alloy with T5 or T6 temper as required by design.
.2 Side track to be reinforced to accept locking hardware.

.12 Air/Vapour retarder: specified in Section 07 25 00.

.13 Liquid Foam Insulation: Single component, moisture cure, low expansion rate spray-in-place polyurethane liquid foam insulation to CAN/ULC-S710.1 and in accordance with manufacturer's written recommendations

2.4 ALUMINUM DOORS AND FRAMES

.1 Doors and framing to be by same manufacturer.

.2 Construct doors assemblies of extruded section to sizes and profiles indicated. Minimum wall thickness of 2.4 mm.

.3 Provide structural steel reinforcement as required.

.4 Provide complete separation of interior and exterior components of door leaf by means of a porthole extruded structural thermal break.

.5 Extruded aluminum with joints machined and fabricated to provide neat hairline joints.

.6 Swing door thickness: 57 mm.

.7 Fabricate doors square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.

.8 Reinforce mechanically-joined corners of doors to produce sturdy door unit.

.9 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.

.10 Fastenings to be concealed.

.11 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08 71 11.

.12 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

2.5 DOOR HARDWARE

.1 Swing doors: in accordance with Section 08 71 11.

.2 Sliding door: in accordance with Section 08 71 11 and as follows:
.1 Multi-point locking.
.2 Locking Deadlock cylinder with key lock.
.3 Handles: Flush mounted pull handles.

2.6 METAL FINISHES

.1 Aluminum finishes:
.1 Finish (extrusions, closures, and trims): to AAMA 2605, 2 coat system with 70% PVDF.
.2 Finish (extrusions, closures, and trims): to AAMA AA-M12C22A31, clear anodized.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum doors and frames installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Install frames and doors in accordance with reviewed shop drawings and manufacturer’s written instructions.

.3 Set frames plumb, square, level at correct elevation in alignment with adjacent Work. Maintain dimensional tolerances and align with adjacent Work.

.4 Install sliding door track to structure plumb and level, free from warp, and allow for sufficient adjustment to accommodate construction tolerances and other irregularities. Use alignment attachments and shims to permanently fasten tracks to building structure.

.5 Anchor frames and doors securely. Install thermal isolation where door frame penetrate or disrupt building insulation

.6 Install doors and hardware in accordance with hardware templates and manufacturer's instructions. Install sill flashings.

.7 Adjust door components to ensure smooth operation.

.8 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

.9 Glaze aluminum doors and frames in accordance with Section 08 80 00.

.10 Seal joints to provide weathertight seal at outside and air/vapour retarders at inside.

.11 Apply sealant in accordance with Section 07 92 00. Conceal sealant within the aluminum Work except where exposed use is permitted by Departmental Representative.

3.3 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.

.2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits:
.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
.2 Twice during progress of Work at 25% and 60% complete.
.3 Upon completion of Work, after cleaning is carried out.

.4 Obtain reports within 3 days of review and submit.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.
.2 Perform cleaning of aluminum components in accordance with AAMA 609.1.
.3 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
.4 Clean aluminum with damp rag and approved non-abrasive cleaner.
.5 Remove traces of primer, caulking, epoxy and filler Materials; clean doors and frames.
.6 Clean glass and glazing Materials with approved non-abrasive cleaner.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by aluminum door and frame installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada/ Woodwork Institue (AWMAC/WI):
.1 AWMAC/WI North American Architectural Woodwork Standards, NAAWS Edition 3-2017.

.2 Canadian Standards Association (CSA International).
.1 CAN/CSA-O132.2 Series-90(R2003), Wood Flush Doors.
.2 CAN/CSA-O132.5-M1992(R1998), Stile and Rail Wood Doors.

.3 Underwriters' Laboratories of Canada (ULC).
.1 CAN/ULC-S104-15, Standard Method of For Fire Tests of Door Assemblies.
.2 CAN/ULC-S105:20169, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

1.2 SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.
.2 Submit two copies of WHMIS SDS - Safety Data Sheets. Indicate VOC's:
.1 For caulking Materials during application and curing.
.2 For door Materials and adhesives.

.2 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 33 00.
.2 Indicate door types and cutouts for lights, fiberglass screens and retainers, sizes, core construction, and cutouts.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit one 300 x 300 mm corner sample of each type wood door.

.3 Show door construction, core, fiberglass screen and retainers, glazing detail and faces.

.4 Manufacturer's Instructions: Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.4 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:
.1 Protect doors from dampness. Arrange for delivery after Work causing abnormal humidity has been completed.
.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
.3 Protect doors from scratches, handling marks and other damage. Wrap doors.
.4 Store doors away from direct sunlight.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging Materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard, polystyrene and plastic packaging Material in appropriate on-site bin for recycling in accordance with site waste management program.

.3 Unused or damaged glazing Materials are not recyclable and must not be diverted to municipal recycling programs.

.4 Divert unused adhesive material from landfill to official hazardous Material collections site approved by Departmental Representative.

.5 Do not dispose of unused paint Materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.
.1 Construction:
.1 Solid particleboard core: stile and rail frame bonded to particleboard core with wood lock blocks and blocking, 5-ply construction.
.2 Face Panels:
.1 Hardwood; veneer grades: Grade I (Premium), white ash species for doors to have clear finish.
.2 Laminated plastic: with hardwood plywood subface for closet doors.
.3 Adhesive: Type I (waterproof)for doors.

2.2 REPRODUCTION STILE AND RAIL DOORS

.1 Fabricate doors as indicated to AWMAC/WI NAAWS and CAN/CSA-O132.5.

.2 Interior door with 45 minute fire rating: fabricate in accordance with CAN/ULC S104, with profile to match exterior door. =

.3 Construction: Architectural grade wood doors: to AWMAC/WI NAAWS mortise and tenon joints, vertical edge AWMAC/WI NAAWS Detail No. 2, stile NAAWS Detail No. 2, Type I (exterior) adhesive. Veneer white ash species, premium grade.

.4 Type: raised panel as indicated.

2.3 LAMINATED PLASTIC

.1 Plastic laminate, backing, adhesive, etc.: In accordance with Section 06 40 01.

2.4 GLAZING

.1 Glass and glazing: in accordance with Section 08 80 00.

2.5 FIBERGLASS SCREEN

.1 Heavy duty, fine fiberglass screen. Provide samples for Departmental Representative’s approval.

2.6 DOOR HARDWARE

.1 In accordance with Section 08 71 11.

2.7 FABRICATION

.1 Vertical edge strips to match face veneer.

.2 Prepare doors for fiberglass screens and glazing. Provide white ash species screen retainers and glazing stops with mitred corners.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mmon lock side and 1.5 mm in 50 mm on hinge side.

.4 Radius vertical edges of double acting doors to 60 mm radius.

.5 Finish laminated plastic smooth and flush with stile edges of door and bevel at approximately 20 degrees.

.6 Provide waterproof non-staining membrane at cutouts on exterior doors to exclude moisture from core.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturers printed instructions.

.3 Adjust hardware for correct function.

.4 Install glazing in accordance with Section 08 80 00.

.5 Install fiberglass screen in accordance with reviewed shop drawings.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing Materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus Materials, rubbish, tools and equipment barriers.

END

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 ASTM International
.1 ASTM A167-99(R2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
.2 ASTM A480/480M-20a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-12.1-2017, Tempered or Laminated Safety Glass.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Safety Data Sheets (SDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for door materials and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate each type of door, sizes, hardware locations, rail shapes and materials.
.3 Submit complete list of hardware for safety glass doors, indicating catalogue and reference identification to specified standards. Include certification of conformance to referenced CGSB standards.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit duplicate 100 x 100 mm samples of safety glass.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for door holders for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect hinged safety glass doors from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 GLASS

.1 Clear safety glass: to CAN/CGSB-12.1, type 2, Class B glazing quality, of thickness indicated.

.2 Glazing gasket: rubber purpose made gasket for dry glazing.

2.2 METAL RAILS AND FITTINGS

.1 Stainless steel: to ASTM A167, Type 314 with satin finish.

2.3 FABRICATION

.1 Cut glass to required size, finish edges as detailed, include cutouts for hardware and other attachments before heat treatment.

.2 Attach top and bottom rails and hardware before shipping doors to site.

.3 Include safety glass sidelights as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for hinged safety glass doors installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Install hinged safety glass doors where indicated.

.3 Adjust operable parts for correct function and smooth operation.

.4 Adjust weatherstripping to ensure weathertight seal.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.
.2 Clean aluminum, stainless steel and bronze with damp rag and approved non-abrasive cleaner in accordance with manufacturer's instructions.
.3 Remove traces of primer, caulking; clean doors and frames.
.4 Clean glass and glazing materials with approved non-abrasive cleaner.
.5 Polish hardware with non-abrasive cleaner as recommended by and in accordance with manufacturer's written instructions.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by hinged safety glass door installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM)
.1 ASTM A653/A653M-20, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
.2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.3 ASTM A1008/A1008M-18, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
.4 ASTM D523-14(R2018), Standard Test Method for Specular Gloss.
.5 ASTM D822/D822M-13(2018), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.105-M91, Quick-Drying Primer.
.2 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coatings.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:
.1 Convene pre-installation meeting 2 weeks prior to beginning Work of this Section and on-site installation, with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other construction subtrades.
.4 Review manufacturer's written installation instructions and warranty requirements.

.2 Hold project meetings as required by Departmental Representative.

.3 Ensure key personnel, Contractor's site supervisor, and Subcontractor representatives attend.

.4 Departmental Representative will submit written notification of change to meeting schedule established upon Contract award 24 hours prior to scheduled meeting.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for doors, hardware, and accessories and include preparation instructions, product characteristics, performance criteria, physical size, installation instructions, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate sizes, service rating, types, Materials, operating mechanisms, glazing locations and details, hardware, and accessories, required clearances.

.4 Certificates: submit product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturers Reports: Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in Part 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for sectional metal doors for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

1.6 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect sectional metal doors, hardware and accessories from nicks, scratches, and blemishes.
.3 Replace defective or damaged Materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 20.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging Materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

.1 Design exterior door assembly to withstand wind load of 1.2 kPa with a maximum horizontal deflection of 1/240 of opening width and a minimum safety factor of 1.5 times wind load.

.2 Design door panel assemblies with thermal insulation factor 3.24 RSI.

.3 Design door assembly to withstand minimum 50,000 cycles per annum, and 10 years total life cycle.

2.2 MATERIALS

.1 Galvanized steel sheet: to ASTM A653/A653M commercial quality Z275 zinc coating.

.2 Steel sheet: commercial quality to ASTM A1008/A1008M, exposed (E), with galvanized finish.

.3 Primer: to CAN/CGSB-1.105 for steel and CAN/CGSB-1.181, for galvanized steel surfaces.

.4 Insulation: Foam in place polyurethane to meet specified RSI value indicated in 2.1 Design Criteria.

.5 Cable: multi-strand galvanized steel aircraft cable.

2.3 DOORS

.1 Fabricate 51 mm thick insulated, flush doors of interlocking steel sections as indicated.

.2 Door skins:
.1 Exterior: minimum 0.912 mm.
.2 Interior: minimum 0.417 mm.

.3 Fabricate panel frames in a continuous box frame with vertical stiffeners at 600 mm centres.

.4 Assemble components by means of spot or arc welding or coated rivet system or adhesive and self tapping screws to manufacturer's recommendations.

.5 Fabricate doors from prepainted steel stock.

2.4 STANDARD DUTY INDUSTRIAL HARDWARE

.1 Track: standard lift hardware with 75 mm size minimum 2.28 mm core thickness galvanized steel track.

.2 Track Supports: 2.3 mm core thickness continuous galvanized steel angle track supports.

.3 Spring counter balance: heavy duty oil tempered torsion spring with manufacturers standard brackets.
- .1 Drum: 133 mm diameter die cast aluminum.
- .2 Shaft: 40 mm diameter solid steel.

.4 Top roller carrier: galvanized steel minimum 2.28 mm thick adjustable.

.5 Rollers: full floating, grease packed hardened steel, ball bearing minimum 75 mm diameter, stamped tire.

.6 Roller brackets: adjustable, galvanized steel, minimum 2.5 mm thick.

.7 Hinges: standard duty industrial 2.28 mm thick galvanized.

.8 Cable: minimum 4 mm diameter galvanized steel aircraft cable.

2.5 ACCESSORIES

.1 Overhead horizontal track and operator supports: galvanized steel, type and size to suit installation.

.2 Track guards: 5 mm thick formed sheet 1500 mm high track guards.

.3 Pusher springs.

.4 Handles:
- .1 Flat bar door latch with night latch.
- .2 Handles: handle operated from outside, handle operated from inside.

.5 Two horizontal sliding lock bolts on interior.

.6 Weatherstripping:
- .1 Sills: bulb type full width extruded neoprene weatherstrip.
- .2 Jambs and head: extruded aluminum and arctic grade vinyl weatherstrip to manufacturer's standard.

.7 Finish ferrous hardware items with minimum zinc coating of 300 g/m^2 to ASTM A123/A123M.

2.6 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied polyvinylidene fluoride.
- .1 Class F2S.
- .2 Colour as indicated on Contract Drawings.
- .3 Specular gloss: 30 units +/- in accordance with ASTM D523.

.4 Coating thickness: not less than 22 micrometres.
.5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822/D822M as follows:
.1 Outdoor exposure period 2500 hours.
.2 Humidity resistance exposure period 5000 hours.

2.7 OPERATORS

.1 Equip doors for operation by:
.1 Hand, two handles on inside face of door.
.2 Chain hoist with galvanized steel chain.

.2 Cable fail safe device. Able to stop door immediately if cable breaks on door free fall. Braking capacity 500 kg.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for sectional metal doors installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Install doors and hardware in accordance with manufacturer's instructions.

.3 Rigidly support rail and operator and secure to supporting structure.

.4 Touch-up steel doors with primer where galvanized finish damaged during fabrication.

.5 Adjust weatherstripping to form a weather tight seal.

.6 Adjust doors for smooth operation.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product within 3 days of review.
.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits to review Work at stages listed:
.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
.2 Twice during progress of Work at 50% and 75% complete.
.3 Upon completion of Work, after cleaning is carried out.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.
.1 Remove traces of primer; clean doors and frames.
.2 Clean glass and glazing Materials with approved non-abrasive cleaner.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20. Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by sectional metal door installation.

END

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 American Architectural Manufacturers Association (AAMA)
.1 AAMA CW-10-15, Care and Handling of Architectural Aluminum From Shop to Site.
.2 AAMA 2605-20, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels - Series: Components, Coatings and Finishes.
.3 AAMA CW-DG-1-96, Aluminum Curtain Wall Design Guide Manual.

.2 ASTM International (ASTM)
.1 ASTM A123/A123M-17, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.3 ASTM B209M-14, Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
.4 ASTM B221M-13, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
.5 ASTM E283-04(2012), Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
.6 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.
.7 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
.8 ASTM E547-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Cyclic Static Air Pressure Difference.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.
.2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.

.4 CSA International
.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA S136-16 Package, North American Specification for the Design of Cold Formed Steel Structural Members including CSA S136S1:19 Supplement 1.
.3 CSA S157-17/S157.1-17, Strength Design in Aluminum/Commentary on CSA S157, Strength Design in Aluminum.
.4 CSA W59.2-18, Welded Aluminum Construction.

.5 National Building Code (NBC) 2015.

.6 Underwriter's Laboratories of Canada (ULC):
.1 CAN/ULC-S710.1:2019, Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Co-ordination: co-ordinate work of this Section with installation of air/vapour retarder placement, flashing placement, and components or materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for curtain wall components, anchorage and fasteners, glass and infill, and internal drainage details and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location, structural sealant, air seal sealant, and details, and field welding required.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit 2 samples 300 x 300 mm in size illustrating prefinished aluminum surface, finish, colour, texture, specified glass units, insulated infill panels, glazing materials illustrating edge and corner.

.5 Test Reports:
.1 Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and supportive data.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for glazed aluminum curtain wall for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Mock-ups:
.1 Construct one mock-up in accordance with Section 01 45 00.
.2 Supply approximately 2500 x 2500 mm mock-up including intermediate mullion, vision glass light, and insulated infill panel.
.1 Assemble to illustrate component assembly including glazing materials, structural sealant, weep drainage system, attachments, anchors, and perimeter sealant.
.3 Locate in-situ mock-up where directed by Departmental Representative.
.4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with work.
.5 When accepted, mock-up will demonstrate minimum standard of quality and materials for work of this Section.
.6 Mock-up may remain as part of finished work.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Handle work of this Section in accordance with AAMA CW-10.
.2 Store materials off ground, in a covered location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.3 Store and protect aluminum glazed curtain wall components from nicks, scratches, and blemishes.
.4 Protect prefinished aluminum surfaces with strippable wrappings or coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
.5 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.7 AMBIENT CONDITIONS

.1 Install sealants when ambient and surface temperature is above 5 degrees C minimum.

.2 Maintain this minimum temperature during and for 48 hours minimum after installation of sealants.

1.6 EXTENDED WARRANTY

.1 Submit an extended warranty for aluminum window work in accordance with General Conditions, except that warranty period is extended to five (5) years.

.1 Warrant against failure to meet the design criteria and requirements such as interior leakage, insulating glass unit failure, finish degradation, frame condensation.

.2 Coverage: Complete replacement including affected adjacent work.

PART 2 - PRODUCTS

2.1 SYSTEMS

.1 Description:

.1 Double glazed structural silicone glazed aluminum curtain wall system includes thermally broken tubular aluminum sections with self supporting framing, shop fabricated, factory prefinished, vision glass, structural silicone, insulated metal panel spandrel infill; related flashings, anchorage and attachment devices.

.2 Assembled system to permit re-glazing of individual glass (and infill panel) units from exterior without requiring removal of structural mullion sections.

.3 Glass and glazing systems: In accordance with Section 08 80 00.

.2 Performance Requirements:

.1 Design glazed curtain wall to AAMA CW-DG-1.

.1 Design glazed aluminum curtain wall following rainscreen principles.

.2 Ensure horizontal members are sealed to vertical members to form individual compartments in accordance with rainscreen principles.

.3 Ventilate and pressure equalize air space outside exterior surface of insulation to exterior.

.4 Ensure complete separation of interior and exterior components by means of a structural thermal break. Do not permit screws to penetrate thermal break.

.2 Design aluminum components to CSA S157/S157.1.

.3 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with NBC and minimum design pressure of 1.19 kPa as measured to ASTM E330/E330M. The greater design pressure shall take precedence.

.4 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable codes.

.5 Limit mullion deflection to L/240 + 6 mm with full recovery of glazing materials.

.6 Size glass units and glass dimensions to limits established in CAN/CGSB-12.20.

.7 Ensure system is designed to accommodate the following without damage to components or deterioration of seals:

.1 Movement within system.

.2 Movement between system and perimeter framing components.

.3 Dynamic loading and release of loads.

.4 Deflection of structural support framing.

.8 Thermal Conductivity of:

.1 Glazing and frame assembly (excluding infill): USI 1.99 maximum.

.2 Vision glass areas: Centre-of-glass USI 1.42, SHGC 0.4 maximum, VLT 0.7.

.9 Limit air infiltration through assembly to 0.02 L/s/m² of wall area, measured at a reference differential pressure across assembly of 300 Pa as measured in accordance with ASTM E283.

.10 Vapour seal with interior atmospheric pressure of 25 mm sp, 22 degrees C, 40% RH: no failure.

.11 Water leakage: none, when measured to ASTM E547 at a differenctial pressure across the assembly of 720 Pa.

.12 Ensure system allows for expansion and contraction within system components when temperature range is 95 degrees C over 12 hour period without causing detrimental effect to system components.

.13 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

.14 Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

.1 Position thermal insulation on exterior surface of air barrier and vapour retarder.

.15 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

.16 Reinforce curtain wall system to accommodate window washing guide rails.

.1 Supply sufficiently rigid anchors to resist loads caused by equipment platform, without damage to wall system

.17 Flatness criteria: Maximum 6 mm in 6 m for each panel.

.18 Design of glass, glazing, and structural silicone joint design to be in accordance with Section 08 80 00.

2.2 MATERIALS

.1 Extruded aluminum: to ASTM B221M, 6063 alloy T5 or T6 temper.

.3 Sheet aluminum: to ASTM B209M.

.4 Sheet steel: to CSA S136, ASTM A653/A653M; galvanized in accordance with 458 g/m2 galvanized coating.

.5 Steel sections: to CSA G40.20/G40.21; shaped to suit mullion sections.

.6 Anchors: 3-way adjustable hot-dip galvanized cast iron.

.7 Fasteners: tamper proof, stainless steel, finish to match curtain wall.

.8 Bituminous paint: CAN/CGSB-1.108, Type 1, without thinner.

.9 Glazing and glazing materials: In accordance with Section 08 80 00.

.11 Sealant:
.1 Airseal sealant: ASTM C920; Type S, Grade NS, Class 50, one-part low modulus silicone, neutral cure. Colour as later selected by Departmental Representative.
.2 Aluminum work sealant: ASTM C920; Type S, Grade NS, Class 50/100 single-Component, low modulus silicone sealant; Colour as selected by Departmental Representative.
.3 Sealant primer and joint backing: type recommended by sealant manufacturer.

2.3 COMPONENTS

.1 Mullion profile:
.1 Nominal 50 mm wide by Nominal 100 mm deep thermally broken, vertical stick built, with interior tubular section insulated from exterior SSG joint.
.2 Matching stops and pressure plate of sufficient size and strength to ensure adequate bite on glass and infill panels.
.3 Drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system.
.4 Internal mullion baffles to eliminate "stack effect" air movement within internal spaces.
.5 Nominal SSG joint width to be 13 mm.

.2 Infill panel: internally reinforced, glazing edge sealed permitting internal air movement to glazing space, outside air barrier line:
.1 Outer face: 3 mm thick aluminum.
.2 Core: Mineral fiber insulation minimum 64 kg/m3 in thickness to achieve minimum assembly RSI 1.06.
.3 Inner face: Overall effective thermal resistance of opaque infill panel assembly: 29.6 kg/m3 for spray foam HFO (low Global Warming Potential) polyurethane, minimum 50 mm thick (to achieve a Class II vapour retarder).

.7 Flashings: 1.0 mm thick aluminum, finish to match curtain wall mullion sections where exposed, secured with concealed fastening method.

.10 Operable sash: specified in Section 08 51 13.

.11 Air/Vapour retarder: specified in Section 07 25 00.

.12 Liquid Foam Insulation: Single component, moisture cure, low expansion rate spray-in-place polyurethane liquid foam insulation to CAN/ULC-S710.1 and in accordance with manufacturer’s written recommendations

2.4 FABRICATION

.1 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

.2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof

.3 Prepare components to receive anchor devices. Install anchors.

.4 Arrange fasteners and attachments to ensure concealment from view.

.5 Prepare system components to receive exterior doors, sliding door, and specified hardware.

.6 Reinforce interior horizontal head rail to receive drapery track brackets and attachments.

.7 Reinforce framing members for external imposed loads.

.8 Visible manufacturer's identification labels not permitted.

.9 Infill Panels:

.1 Fabricate infill panels with metal covered edge seals around perimeter of panel assembly, enabling installation and minor movement of perimeter seal.

.2 Reinforce interior surface of exterior panel sheet from deflection caused by wind and suction loads.

.3 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

.4 Place insulation within panel, adhered to exterior face of interior panel sheet over entire area of sheet with impale fasteners.

.5 Ventilate and pressure equalize the air space outside the exterior surface of the insulation, to the exterior.

.6 Arrange fasteners and attachments to ensure concealment from view.

.10 Finishes:

.1 Finish (extrusions, panels, closures, and trims): to AAMA 2605, 2 coat system with 70% PVDF.

.2 Finish (extrusions, panels, closures, and trims): to AAMA AA-M12C22A31, clear anodized.

.11 Concealed steel items: galvanized in accordance with ASTM A123/A123M Coating Grade 85, 600 gm/m².

.12 Apply 1 coat of bituminous paint, maximum 200 g/L maximum, to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

2.5 SOURCE QUALITY CONTROL

.1 Perform work in accordance with AAMA CW-I-9. Maintain 1 copy on site.

.2 Manufacturer qualifications: company specializing in manufacturing the products specified in this section with minimum 5 years experience.

.3 Installer qualifications: company specializing in performing the work of this section approved by manufacturer.

.4 Design structural support framing components to CSA S157/S157.1 under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located in the Province of Ontario.

.5 Perform welding Work in accordance with CSA W59.2.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum curtain wall installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Verify dimensions, tolerances, and method of attachment with other work.

.3 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this Section.

.4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install curtain wall system in accordance with reviewed shop drawings and manufacturer's instructions.

.2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.3 Use alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.

.4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

.5 Use thermal isolation where components penetrate or disrupt building insulation.

.6 Install sill flashings.

.9 Co-ordinate attachment and seal of perimeter air/vapour retarder materials.

.10 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

.14 Install glass and glazing in accordance with reviewed shop drawings, manufacturer’s written instructions, and Section 08 80 00.

.15 Install perimeter sealant to method required to achieve performance criteria in accordance with Section 07 92 00.

3.3 SITE TOLERANCES

.1 Maximum variation from plumb: 1.5 mm/m non-cumulative or 12 mm/30 m, whichever is less.

.2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.

.3 Maximum sealant space between curtain wall and adjacent construction: 13 mm.

3.4 FIELD QUALITY CONTROL

.1 Inspection by independent testing agency will monitor quality of installation and glazing.
.1 Test system to: ASTM E1105.

.2 Manufacturer's Field Services:
.1 Obtain written report from manufacturer of curtain wall and or glass verifying compliance of Work, in handling, installing, applying, protecting and cleaning of products, and submit written reports in acceptable format to verify compliance of Work with Contract within 3 days of review.
.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Ensure manufacturer's representative of curtain wall and of glass is present before and during critical periods of installation.
.4 Schedule site visits to review Work at stages listed:
.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
.2 Twice during progress of Work at 25% and 60% complete.
.3 Upon completion of Work, after cleaning is carried out.

3.5 ADJUSTING

.1 Adjust operating sash for smooth operation.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.
.2 Remove protective material from prefinished aluminum surfaces.
.3 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
.4 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

.5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by glazed aluminum curtain wall installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI).
.1 ANSI H35.1/H35.1M-17, Alloy and Temper Designation Systems for Aluminum (Metric).

.2 American Society for Testing and Materials International, (ASTM)
.1 ASTM B221M-13, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes (metric).
.2 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

.3 Canadian Standards Association (CSA) International.
.1 AAMA/WDMA/CSA-101/I.S.2/A440-19, NAFS - North American Fenestration Standard/ Specification for Windows, Doors and Skylights.
.2 CSA A440S1-17, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS - North American Fenestration Standard/Specification for windows, doors, and skylights.

.4 Insulating Glass Manufacturers Association of Canada (IGMAC)
.1 North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use - 2004.

.5 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-79.1-M91, Insect Screens.

.6 Underwriters Laboratories of Canada (ULC)
.1 CAN/ULC-S701.1-17, Standard for Thermal Insulation, Polystyrene Boards.

1.2 DESIGN REQUIREMENTS

.1 Design aluminum window Work to accommodate following without producing detrimental effect:
.1 Cyclic 40 degrees C daily thermal swing of components.
.2 Cyclic, dynamic loading and release of loads such as wind loads.
.3 13 mm vertical deflection in supporting structure and movement of supporting structure due to live, dead load, and creep or deflections, seismic load, sway displacement and similar items.

.2 Design window system to prevent accumulation of condensate on interior side of aluminum Work framing under the service conditions respective to Place of Work.

.3 Design and detail controlled drainage path to actively discharge water, which enters into or forms within steel Work, to exterior; prevent accumulation or storage of water within steel Work. Prevent water from entering interior when tested in accordance with ASTM E331.

.4 Design aluminum windows in accordance to AAMA/WDMA/CSA-101/I.S.2/A440, to meet performance levels as follows:
.1 Performance class: CW.
.2 Minimum performance grade (PG): 30.
.3 Minimum positive design pressure: 1440 Pa.
.4 Minimum negative design pressure: - 1440 Pa.
.5 Minimum water penetration test pressure: 220 Pa.
.6 Minimum air infiltration/exfiltration: A3.

.5 Design Double glazed window system, including glazing, to meet the following minimum performance criteria:
.1 Visible light transmittance (LT): 58%.
.2 Solar energy transmittance: 27%.
.3 UV light transmittance: 12%.
.4 Centre of glass U-Value (winter): 0.18.
.5 Solar heat gain coefficient (SHGC): 0.33.
.6 Shading coefficient: 0.38.

.6 Design and detail air barrier, vapour retarder, and rainscreen products and assemblies into continuous and integrated steel Work envelope. Optimize aluminum Work design to align envelope layers and to minimize thermal bridges.

.7 Prevent deflection and permanent or progressive glazing displacement. Restrict horizontal and vertical mullion deflection to less than L/175 (under uniformly distributed positive design wind load), and 10 mm maximum regardless of span.

.8 Design anchorage inserts for installation as part of other Sections of Work. Design anchorage assemblies to accommodate construction and installation tolerances.

1.3 SUBMITTALS.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for aluminum windows and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate Materials and details in full size scale for head, jamb and sill, profiles of components, elevations of unit, anchorage details, location of isolation coating, description of related components, exposed finishes fasteners, caulking and juncture with adjacent construction. Indicate location of manufacturer's nameplates.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into Work.
.3 Submit one complete full size window sample of each type window.

.4 Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.
.5 Include 150 mm long samples of head, jamb, sill, mullions to indicate profile.

.5 Test and Evaluation Reports:
.1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications.
.2 All test reports that reference the NAFS must include, on the first page, a summary of the results including, at minimum:
.1 The product manufacturer.
.2 The type of product.
.3 The model number/series number.
.4 The primary product designation.
.5 The secondary product designation.
.1 Positive design pressure.
.2 Negative design pressure.
.3 Water penetration resistance test pressure.
.4 Canadian air infiltration and exfiltration levels.
.6 The test completion date.
.3 The report will also contain the following information:
.1 Test dates.
.2 Report preparation dates.
.3 Test information retention period.
.4 Location of testing facilities.
.5 Full description of test samples, including:
.1 Anodized finish, weathering characteristics.
.2 Condensation resistance.
.3 Sash strength and stiffness - operable window.
.4 Forced entry resistance.
.6 Complete description of amendments, as applicable.
.7 Conclusion.
.8 Drawings signed by the testing laboratory, if provided.

.6 Certifications: product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.7 Closeout submittals:
.1 Submit in accordance with Section 01 78 00.
.2 Operation and Maintenance Data: submit operation and maintenance data for windows for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Mock-Up:
.1 Construct mock-up in accordance with Section 01 45 00.
.2 Construct one full scale mock-up of an aluminum window demonstrating full range of products, finishes, textures, quality of fabrication, and workmanship.
.3 Locate where directed by the Departmental Representative.
.4 Mock-up may remain as part of finished Work if accepted by the Departmental Representative.

.5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with aluminum window Work.

1.5 STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions and IGMAC recommendations.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect aluminum windows from nicks, scratches, and blemishes.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.6 EXTENDED WARRANTY

.1 Submit an extended warranty for aluminum window Work in accordance with General Conditions, except that warranty period is extended to five (5) years.
.1 Warrant against failure to meet the design criteria and requirements such as interior leakage, insulating glass unit failure, finish degradation, frame condensation.
.2 Coverage: Complete replacement including affected adjacent Work.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General:
.1 Materials: to AAMA/WDMA/CSA 101/I.S.2/A440 supplemented as specified herein.
.2 All windows by same manufacturer.

.2 Aluminum Materials:
.1 Aluminum extrusions: ASTM B221M and ANSI H35.1, AA6063 alloy, T6 temper.
.2 Aluminum alloy and finish: to AAMA/WDMA/CSA-101/I.S.2/A440 and CSA A440S1, clear anodized, Class 1, per Aluminum Association Designation System for Aluminum Finishes AA-M12C22A31, minimum 50% recycled content.

.3 Thermal break: cork-neoprene composition or extruded or poured rigid polyvinyl chloride.

.5 Airseal transition membrane: Identical to, or compatible with, building air/vapour barrier Materials under Section 07 25 00 and meet requirements as specified herein.

.6 Sealants:
.1 Arseal sealant: ASTM C920; Type S, Grade NS, Class 50, one-part low modulus silicone, neutral cure. Colour as later selected by Departmental Representative.
.2 Aluminum Work sealant: ASTM C920; Type S, Grade NS, Class 50/100 single-Component, low modulus silicone sealant; Colour as selected by Departmental Representative.
.3 Sealant primer and joint backing: type recommended by sealant manufacturer.

.7 Insulation: expanded polystyrene to CAN/ULC-S701.1, Type 3, Ecologo certified.

.8 Bituminous paint: acid and alkali resistant.

.9 Screens: to CAN/CGSB-79.1, Type 2 heavy duty, to suit window type, aluminum screening, 18 x 14 mesh; clear anodized aluminum Class 1 finish, heavy duty S2, screen strength rating to AAMA/WDMA/CSA-101/I.S.2/A440 and CSA A440S1.

.10 Fasteners: stainless steel, type 316.

.11 Weatherstripping: to AAMA/WDMA/CSA-101/I.S.2/A440 and CSA A440S1.

.12 Window hardware:
.1 Manually operated window hardware: Manufacturer's standard heavy duty corrosion resistant hardware, to provide security and permit easy operation of units.
.2 Automatic window hardware:
.1 Conforming to AAMA/WDMA/CSA-101/I.S.2/A440.
.2 Windows are to be electrically controlled from the ground level where shown on Contract Drawings.
.3 Provide complete remote operation system with wiring by Division 26.
.4 Motorized system to be complete with features such as rain sensor, built-in thermostat, power conversion, power blind system compatibility, protected memory and safety reversal.
.5 System to have wall mounted control panels and hand held remotes as required by Departmental Representative.

2.2 FABRICATION

.1 Fabricate in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, reviewed shop drawings and manufacturer's written instructions.

.2 Fabricate fixed, awning and casement windows as required for Work of this Project to meet requirements of AAMA/WDMA/CSA-101/I.S.2/A440.

.3 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints. Apply frame sealant at joints to provide continuity of water and air barrier.

.4 Fabricate continuous sill flashings with intermediate anchor clips, and joint reinforcing, form to profile shown. Fabricate filler and closure pieces as necessary for a complete and weather tight installation.

.5 Extruded aluminum sills to profiles indicated.

.6 Certify aluminum windows as complying with the AAMA/WDMA/CSA 101/I.S.2/A440 design criteria and requirements using an easily removable label located on the inside face of glazing.

.7 Position operable windows on main frame to provide direction of opening specified, free and smooth operation, without binding or sticking against main frame members.

.8 Face dimensions detailed are maximum permissible sizes.

.9 Units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.

.10 Form flashing to profiles indicated.

.11 Build in structural deflection allowance to prevent transfer of structural load to windows.

.12 Build thermal expansion allowance to withstand 85°C temperature difference without stressing sealants.

.13 Insulated panels:
.1 Form insulated aluminum spandrel panels to profiles indicated composed of 1.2 mm thick sheet aluminum faces laminated to insulation in thickness as indicated.
.2 Laminate members together under heat and pressure and seal edges of panels.
.3 Supply and install extruded aluminum frames (thermally broken) for insulated panels, complete with trim, stops, etc.

.14 Double weatherstrip windows. Install weatherstripping in specially extruded ports and secure to prevent shrinkage or movement.

.15 Finishes:
.1 Finish (extrusions, panels, closures, and trims): to AAMA 2605, 2 coat system with 70% PVDF.
.2 Finish (extrusions, panels, closures, and trims): to AAMA AA-M12C22A31, clear anodized.

.16 Concealed steel items: galvanized in accordance with ASTM A123/A123M Coating Grade 85, 600 gm/m².

.17 Apply 1 coat of bituminous paint, maximum 200 g/L maximum, to concealed aluminum and steel surfaces in contact with cementitious or dissimilar Materials.

2.3 AIRSEAL TRANSITION MEMBRANE

.1 Equip window frames with site installed airseal transition membrane Material for sealing to building air/vapour barrier as follows:
.1 Material: identical to, or compatible with, building air/vapour

barrier Materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
.2 Material width: adequate to provide required air tightness and vapour diffusion control to building air/vapour barrier from interior.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum window installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install aluminum windows in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, reviewed shop drawings and manufacturer’s written instructions.

.2 Apply bituminous paint to aluminum in contact with concrete and masonry.

.3 Units plumb, square and level to 1:400; free of warp, twist and superimposed loads; weathertight.

.4 Securely anchor units in place with concealed fasteners.

.5 Fill voids between aluminum framing and adjacent construction with foam insulation in accordance with Section 07 21 29.03.

.6 Sills:
.1 Install sills in maximum lengths possible. For sills over 1200 mm in length, maintain 3 mm to 6 mm space at each end.
.2 Fix sills in place, level, with uniform wash to exterior.
.3 Install drip deflectors.

.7 Caulking:
.1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
.2 Apply sealant in accordance with manufacturer’s written instructions. Conceal sealant within window units except where exposed use is permitted by Departmental Representative.
.3 Tool sealant. Remove excess sealant.

.8 Adjust opening sash and hardware to operate smoothly and for correct function.

3.3 GLAZING

.1 Window: in accordance with AAMA/WDMA/CSA-101/I.S.2/A440 and CSA A440S1, Glazing Recommendations for Sealed Insulating Glass Units and requirements of Section 08 80 00.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by window installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Aluminum Association(AA).
.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes

.2 American National Standards Institute (ANSI).
.1 ANSI H35.1/H35.1M-17, Alloy and Temper Designation Systems for Aluminum (Metric).

.3 ASTM International (ASTM).
.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip galvanized) Coatings on Iron and Steel Products.
.2 ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus.
.3 ASTM B221M-13, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.
.4 ASTM D523-14(2018), Standard Test Method for Specular Gloss.
.5 ASTM D2244-16, Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
.6 ASTM D2247-15, Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
.7 ASTM D2794-93(2019), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
.8 ASTM D3359-17, Standard Test Methods for Rating Adhesion by Tape Test.
.9 ASTM D3363-05(2011)e2, Standard Test Method for Film Hardness by Pencil Test.
.10 ASTM D4214-07(2015), Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
.11 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
.12 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
.13 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

.4 Canadian Standards Association (CSA International).
.1 AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.
.2 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steels.

.5 Society for Protective Coatings(SSPC).
.1 SSPC-SP8-1982(R2004), Pickling.
.2 SSPC-SP16-2010, Brush-off Blast Cleaning Non-Ferrous Metals.

1.2 DESIGN REQUIREMENTS

.1 Design historic steel window Work to accommodate following without producing detrimental effect:
.1 Cyclic 40 degrees C daily thermal swing of components.
.2 Cyclic, dynamic loading and release of loads such as wind loads.
.3 13 mm vertical deflection in supporting structure and movement of supporting structure due to live, dead load, and creep or deflections, seismic load, sway displacement and similar items.

.2 Design window system to prevent accumulation of condensate on interior side of steel Work framing under the service conditions respective to Place of Work.

.3 Design window systems to have a maximum air infiltration 0.774 (l/s)/m. of crack length with differential pressure across window unit of 0.30 kPa, when measured in accordance with ASTM E283/E283M.

.4 Design window systems to allow no water penetration for 15 minutes when window is subjected to a rate of flow of 12.2 m/h. with differential pressure across window unit of 0.215 kPa, when measured in accordance with ASTM E331.

.5 Design window systems to have no damage at 60 PSF, when measured in accordance with ASTM E330/E330M.

.6 Design window systems to meet Grade 40 at 136 pounds for forced entry, when measured in accordance with ASTM F588.

.7 Design and detail controlled drainage path to actively discharge water, which enters into or forms within steel Work, to exterior; prevent accumulation or storage of water within steel Work. Prevent water from entering interior when tested in accordance with ASTM E331.

.8 Design historic steel windows in accordance to AAMA/WDMA/CSA-101/I.S.2/ A440, to meet performance levels as follows:
.1 Performance class: CW.
.2 Minimum performance grade (PG): 30.
.3 Minimum positive design pressure: 1440 Pa.
.4 Minimum negative design pressure: - 1440 Pa.
.5 Minimum water penetration test pressure: 220 Pa.
.6 Minimum air infiltration/exfiltration: A3.

.9 Design double glazed window system, including glazing, to achieve a Centre of glass U-Value (winter) of 0.25.

.10 Design and detail air barrier, vapour retarder, and rainscreen products and assemblies into continuous and integrated steel Work envelope. Optimize steel Work design to align envelope layers and to minimize thermal bridges.

.11 Prevent deflection and permanent or progressive glazing displacement. Restrict horizontal and vertical mullion deflection to less than L/175 (under uniformly distributed positive design wind load), and 10 mm maximum regardless of span.

.12 Design anchorage inserts for installation as part of other Sections of Work. Design anchorage assemblies to accommodate construction and installation tolerances.

.13 Provide finishing system meeting the following requirements:
.1 Acid pickling: To SSPC-SP8.
.2 Hot dip galvanize: To ASTM A123/A123M.
.3 Adhesion: To ASTM D3359, no loss.
.4 Hardness: To ASTM D3363 (pencil), H min.
.5 Salt spray: ASTM B117, passes 3000 hrs.
.6 Humidity: ASTM D2247, 3000 hours, few #8 blisters.
.7 Impact resistance (3 mm): ASTM D2794, no loss.
.8 Colour retention: ASTM D2244, 5 year less than or equal to 5 delta.
.9 Chalk resistance: ASTM D4214, #8 rating.
10. Gloss retention: ASTM D523, greater than or equal to 30 percent retention.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for historic steel windows and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate Materials and details in full size scale for head, jamb and sill, profiles of components, elevations of unit, anchorage details, description of related components, exposed finishes fasteners, caulking and juncture with adjacent construction. Indicate location of manufacturer's nameplates.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into Work.
.3 Submit one complete full size window sample of each type window.
.4 Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.
.5 Include 150 mm long samples of head, jamb, sill, mullions to indicate profile.

.5 Test and Evaluation Reports:
.1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications.

.2 All test reports that reference the NAFS must include, on the first page, a summary of the results including, at minimum:
- .1 The product manufacturer.
- .2 The type of product.
- .3 The model number/series number.
- .4 The primary product designation.
- .5 The secondary product designation.
  - .1 Positive design pressure.
  - .2 Negative design pressure.
  - .3 Water penetration resistance test pressure.
  - .4 Canadian air infiltration and exfiltration levels.
- .6 The test completion date.

.3 The report will also contain the following information:
- .1 Test dates.
- .2 Report preparation dates.
- .3 Test information retention period.
- .4 Location of testing facilities.
- .5 Full description of test samples, including:
  - .1 Powder coated finish, weathering characteristics.
  - .2 Condensation resistance.
  - .3 Sash strength and stiffness - operable window.
  - .4 Forced entry resistance.
- .6 Complete description of amendments, as applicable.
- .7 Conclusion.
- .8 Drawings signed by the testing laboratory, if provided.

.6 Certifications: product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.7 Closeout submittals:
- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for windows for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Mock-Up:
- .1 Construct mock-up in accordance with Section 01 45 00.
- .2 Construct one full scale mock-up of a historic steel window demonstrating full range of products, finishes, textures, quality of fabrication, and workmanship.
- .3 Locate where directed by the Departmental Representative.
- .4 Mock-up may remain as part of finished Work if accepted by the Departmental Representative.
- .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with historic steel window Work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect historic steel windows from nicks, scratches, and blemishes.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.6 EXTENDED WARRANTY

.1 Submit an extended warranty for historic steel window Work in accordance with General Conditions, except that warranty period is extended to ten (10) years.
.1 Warrant against failure to meet the design criteria and requirements such as interior leakage, insulating glass unit failure, finish degradation, and frame condensation.
.2 Coverage: Complete replacement including affected adjacent Work.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General:
.1 Materials: to AAMA/WDMA/CSA 101/I.S.2/A440 supplemented as specified herein.
.2 All windows by same manufacturer.

.2 Billet steel: Solid, hot rolled steel conforming to CSA G40.20/G40.21.

.3 Aluminum extrusions: ASTM B221M and ANSI H35.1, AA6063 alloy, T5 temper.

.4 Reinforcements, and anchors clips, and angles: To CSA G40.20/G40.21, sizes and shapes shown or as required.

.5 Glass and glazing Materials: In accordance with Section 08 80 00.

.6 Screens:
.1 Manufacturer’s standard stainless steel screens
.2 Frames shall be roll-formed 0.912 mm stainless steel.
.3 Stainless steel screens shall be 0.3 mm diameter wire, woven to 14 x 18 mesh count.
.4 Fasteners: tamper proof.

.7 Isolation coating: alkali resistant bituminous paint.

.8 Airseal transition membrane: Identical to, or compatible with, building air/vapour barrier Materials under Section 07 25 00 and meet requirements as specified herein.

.9 Sealants:
.1 VOC limit 250 g/L maximum.
.2 Airseal sealant: ASTM C920 and SWRI Validated; One part silicone, neutral cure, elastomeric sealant. Colour as later selected by Departmental Representative.
.3 Steel Work sealant: ASTM C920; Single-Component, silicone sealant; Colour as selected by Departmental Representative.
.4 Sealant primer and joint backing: type recommended by sealant manufacturer and SWRI validated.

.10 Window hardware: Manufacturer’s standard heavy duty corrosion resistant hardware, to provide security and permit easy operation of units.

.11 Weatherstripping shall be extruded EPDM closed cell sponge, closed cell neoprene, or flexible silicone, or polyethylene clad urethane foam.

.12 Fasteners: All fasteners shall be stainless steel, excluding glazing bead retainer screws which are plated steel.

2.2 FABRICATION

.1 Fabricate in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, reviewed shop drawings and manufacturer’s written instructions. Refer to Drawings for window profile and operations.

.2 Fabricate sections true to detail, free from defects impairing appearance, strength and durability. Fabricate rolled shapes with sharp, well defined corners.

.3 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints. Apply frame sealant at joints for weatherproof seams.

.4 Conceal anchors, reinforcement and attachments from view. Fabricate reinforcement in accordance with design requirements.

.5 Do not expose manufacturer's identification labels on steel assemblies.

.6 Fabricate continuous sill flashings with intermediate anchor clips, and joint reinforcing, form to profile shown. Fabricate filler and closure pieces as necessary for a complete and weather tight installation.

.7 Fabricate steel Work closures and trim from steel sheet. Form to profile shown. Make weathertight.

.8 Heavy custom double weatherstripped windows shall be manufactured from solid hot-rolled steel shapes.
.1 Profiles made from steel with flanges rolled integrally at the mill.

.2 Perimeter frames and ventilator sections shall have glazing rebates providing an unobstructed glazing surface of at least 10 mm.
.3 The exterior side of the glazing rebate shall have a coved recess integrally rolled in the profile. Applied tapered adapters will not be acceptable.
.4 Combined weight of frame and ventilator profiles shall be a minimum of 6.96 kg per lineal metre. Frame profile alone shall not weigh less than 2.75 kg per lineal metre.
.5 All steel profiles must be a minimum of 47 mm in depth.
.6 The frame profiles shall have integral grooves located on the interior bedding contacts for the reception of weatherstripping.

.9 Muntins:
.1 Hot-rolled steel muntins shall have a 22 mm sightline with integral coves to match perimeter frame and ventilator profiles.
.2 True divided lite muntins shall be welded to the perimeter frame. Muntin intersections shall be slotted, cross notched and welded.

.10 Beads: Glazing beads shall be extruded aluminum alloy 6063-T5 with a minimum thickness of 1.1 mm.

.11 Corners of frame and ventilator shall be mitered or coped then solidly welded. Exposed and contact surfaces shall be finished smooth flush with the adjacent surfaces. All interior and exterior rail bar and muntin joints shall be welded and ground smooth.

.12 Stainless steel screens:
.1 Stainless steel screen frames shall be finished to match the windows.
.2 Stainless steel screens shall be rewireable to allow for mesh replacement.
.3 Stainless steel screen fastenings shall permit easy attachment and removal from the interior.

.13 Face dimensions detailed are maximum permissible sizes.

.14 Brace frames to maintain squareness and rigidity during shipment and installation.

.15 All ventilators shall receive continuous EPDM weatherstripping that shall be applied to the integral weatherstrip grooves on the interior. Exterior shall have adhesive backed silicone bulb EPS on sealing leg contact surfaces between the frame and ventilator sections.

.16 Allowable tolerances: Size dimensions +1.5 mm.

2.3 FACTORY FINISHES

.1 Aluminum finishes (beads): Manufacturer’s standard finish for beads, conforming to AA DAF 45 requirements.

.2 Powder coating:
.1 Manufacturer’s standard heavy duty powder coating suitable for coastal environments and as specified herein.

.2 Colour and finish to be selected by the Departmental Representative.
.3 Combined overall dry film thickness (DFT) of hot-dip galvanizing, epoxy primer, and polyester powder top coat shall be between 0.20 – 0.40 mm.
.4 Window systems shall undergo the following procedures for finishing Work:
.1 Cleaning: All hot-rolled steel profiles must be acid pickled to white metal as defined by SSPC – SP8 creating a pristine, white metal substrate which is paramount to achieving ultimate finish performance.
.2 Pretreatment: Following welding and all machining operations, hot-rolled products and accessories are subjected to the following pretreatment process.
.1 Hot-dip galvanize: Parts are cleaned and immersed in a molten pool of pure zinc per ASTM A123/A123M to create a thickness of 0.10 – 0.20 mm of cathodic protection.
.2 Quality control.
.3 Mechanical cleaning.
.3 Brush-off blast cleaning:
.1 Galvanized parts shall be brush-off blast cleaned in accordance with SSPC-SP16 to profile surface prior to primer application.
.2 All parts shall be oven heated prior to finishing to prevent outgassing through epoxy primer.
.4 Epoxy powder primer: Following pretreatment and brush-off blast cleaning all parts shall receive an abrasion resistant epoxy powder coat to ensure ultimate substrate protection. Epoxy powder primer is intended as an intermediate finish applied prior to the final finish top coat.
.1 Within 12 hours of hot-dip galvanizing pretreatment all frames and accessories shall receive an epoxy powder primer for abrasion resistance.
.2 After hot-dip galvanizing has been cleaned, brush-off blasted, and oven outgassed – epoxy powder primer is applied electrostatically to a dry film thickness (DFT) of 0.051-0.10 mm.
.3 Parts are oven baked in preparation of top coat application.
.5 Polyester powder top coat: The top coat defines the final stage to the overall aesthetics and performance of the finished product.
.1 Polyester powder top coat shall be applied immediately over epoxy powder primer.
.2 Powder top coat is electrostatically applied to a dry film thickness (DFT) of 0.051-0.10 mm.
.3 Parts are oven baked to fully cure.

2.4 ISOLATION COATING

.1 Coating in accordance with manufacturer's recommendations for surface conditions.

.2 Isolate aluminum from following components, by means of isolation coating:
.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
.2 Concrete, mortar and masonry.
.3 Wood.

2.5 GLAZING

.1 Glaze windows in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 and Section 08 80 00.

.2 All windows shall be designed for inside glazing.

.3 Provide replaceable continuous glazing beads to suit the glass as specified.

.4 Glazing beads shall be cut and shop fitted to each glass lite prior to shipment.

2.6 AIRSEAL TRANSITION MEMBRANE

.1 Equip window frames with site installed airseal transition membrane Material for sealing to building air/vapour barrier as follows:
.1 Material: identical to, or compatible with, building air/vapour barrier Materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
.2 Material width: adequate to provide required air tightness and vapour diffusion control to building air/vapour barrier from interior.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for historic steel window installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install historic steel windows in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, reviewed shop drawings and manufacturer’s written instructions.

.2 Set units plumb, level and true to line, without warp or rack of frames.

.3 Anchor units securely to surrounding construction with approved fasteners.

.4 Fill voids between steel framing and adjacent construction with foam insulation in accordance with Section 07 21 29.03.

.5 The exterior joints between the windows, trim and mullions shall be properly sealed watertight with an approved sealant and neatly pointed.

.6 Attach ventilator hardware, as required, and adjust ventilators to operate smoothly free from twist and to be weathertight when closed.

.7 Attach loose muntin grids per reviewed shop drawings, if applicable.

.8 Install sills in maximum lengths possible. For sills over 1200 mm in length, maintain 3 mm to 6 mm space at each end.

.9 Caulking:
.1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
.2 Apply sealant in accordance with manufacturer's written instructions. Conceal sealant within window units except where exposed use is permitted by Departmental Representative.
.3 Tool sealant. Remove excess sealant.

.10 Adjust operable parts for smooth and correct function.

.11 Repair any abraded areas of the factory finish.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by window installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
.1 ANSI/BHMA A156.1-2016, American National Standard for Butts and Hinges.
.2 ANSI/BHMA A156.2-2017, Bored and Preassembled Locks and Latches.
.3 ANSI/BHMA A156.3-2014, Exit Devices.
.4 ANSI/BHMA A156.4-2019, Door Controls - Closers.
.5 ANSI/BHMA A156.6-2015, Architectural Door Trim.
.6 ANSI/BHMA A156.8-2015, Door Controls - Overhead Stops and Holders.
.7 ANSI/BHMA A156.10-2017, Power Operated Pedestrian Doors.
.8 ANSI/BHMA A156.13-2017, Mortise Locks.
.9 ANSI/BHMA A156.14-2019, Sliding and Folding Door Hardware.
.10 ANSI/BHMA A156.16-2018, Auxiliary Hardware.
.11 ANSI/BHMA A156.18-2016, Materials and Finishes.
.12 ANSI/BHMA A156.19-2019, Power Assist and Low Energy Power - Operated Doors.
.13 ANSI/BHMA A156.21-2019, Thresholds.
.14 ANSI/BMHA A156.22-2017, Door Gasketing and Edge Seal Systems.

.2 Canadian Steel Door Manufacturers' Association (CSDMA)
.1 CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions - 2020.

.3 Canadian Standards Association (CSA)
.1 CSA B651-18, Accessible Design for the Built Environment.

.4 Door Hardware Institute (DHI)

.5 Underwriter’s Laboratory (UL)
.1 UL 294 Ed. 7-2018, Standard for Access Control System Units.

.6 Underwriter’s Laboratory of Canada (ULC)
.1 ULC S318-96(R2016), Standard for Power Supplies for Burglar Alarm Systems.

1.2 DESIGN REQUIREMENTS

.1 Design hardware in fire-rated doors to meet fire resistance rating requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
.1 Submit for review and acceptance of each "Heritage Hardware" component listed on hardware schedule.
.2 Samples will be returned for inclusion into Work.
.3 Identify each sample by label indicating applicable specification paragraph number, finish and hardware package number.
.4 After approval samples will be returned for incorporation in Work.

.4 Hardware List:
.1 Submit Contract hardware list.
.2 Indicate specified hardware, including make, model, Material, function, size, finish and other pertinent information.

.5 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:
.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:
.1 Store Materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect door hardware from nicks, scratches, and blemishes.
.3 Protect prefinished surfaces with strippable coating.
.4 Replace defective or damaged Materials with new.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging Materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.
.2 All hardware to be grade 1.
.3 Finish for hardware items to be approved by Departmental Representative.

2.2 DOOR HARDWARE

.1 Locks and latches:
  .1 Bored and preassembled locks and latches: to ANSI/BHMA A156.2, series 4000 preassembled lock, grade 1, designed for function as stated in Hardware Schedule.
  .2 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, designed for function as stated in Hardware Schedule.
  .3 Flush Bolts: to ANSI/BHMA A156.16, L04251.
  .4 Dust Proof Strikes: to ANSI/BHMA 156.16, L14011.
  .5 Lever handles: special straight and tapered level handle design, complete with return.
  .6 Roses: round.
  .7 Normal strikes: box type, lip projection not beyond jamb.
  .8 Cylinders: key into keying system as directed.
  .9 Finished to 622 (Flat - black) or 626 (Brass) as indicated on hardware schedule.

.2 Butts and hinges:
  .1 Butts and hinges: to ANSI/BHMA A156.1, Grade #A8111. Five (5) knuckle, ball bearing, heavy weight full mortise hinge. Finished to 622 (Flat - black) or 652 (Brass) as indicated on hardware schedule.

.3 Exit devices: to ANSI/BHMA A156.3.

.4 Door Closers and Accessories:
  .1 Door controls (closers surface – Office Building and Residence Building): to ANSI/BHMA A156.4, as listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4 Grade 2, table A1, finished to 693 (Painted Black).
  .2 Door controls (Garage/Utility Building): heavy duty to ANSI/BHMA A156.4, as listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4 Grade 1, table A1, finished to 689 (Aluminum).

.5 Architectural door trim: to ANSI/BHMA A156.6, size and finish listed in Hardware Schedule.

.6 Sliding and folding door hardware: to ANSI/BHMA A156.14, finish as listed in Hardware Schedule finished.
.1 Pocket sliding doors: surface mounted exposed track, with fascia board, header track, quick release hangar, guide at floor.
.1 Accessory item: 90 Degree offset pull.
.2 Dual Bi-passing sliding door hardware: double leg aluminum.
.1 Accessory item: flush door pull.
.2 Accessory item: Hook Dead bolt, type MS1850SN-050, finished to 622. Key into keying system as directed.

.7 Door bottom seal: door seal of extruded aluminum frame and solid closed cell neoprene weather seal, surface mounted, closed ends.

.8 Thresholds: 127mm wide x full width of door opening, extruded aluminum mill finish, serrated surface, with thermal break of rigid PVC.

.9 Weather-stripping:
.1 Head and jamb seal:
.1 Adhesive backed neoprene Material.

.10 Electric Strikes: Refer to ANSI/BHMA A156.31, Grade 1 for endurance and dynamic strength. Meets ANSI/BHMA A156.31, Grade 1, 680 kg static strength. Heavy duty stainless steel construction.

.11 Door contact: concealed magnetic switches.

.12 Power Supplies: UL 294, ULC-S318 certified.

.13 Wall Stops to ANSI/BHMA 156.16 L52101. Finish listed in hardware schedule.

.14 Viewer: One-way wide angle viewer to ANSI/BHMA A156.16 L23172. Finish as listed on the hardware schedule.

.15 Heritage Hardware: Source the heritage hardware as listed in the schedule (hinges and lockset with lever handle).
.1 Finish to be brass to coordinate with new door hardware on the same door.
.2 All heritage hardware to be salvaged stock from a Supplier located in Ontario.
.3 All heritage hardware to be manufactured prior to 1917 and previously used on an institutional building.
.4 Approval from Departmental Representative is required prior to order and installation of heritage hardware.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with Material through which they pass.

2.4 KEYING

.1 Doors and cabinet locks to be as directed. Prepare detailed keying schedule in conjunction with Departmental Representative.

.2 Supply keys in duplicate for every lock in this Contract.

.3 Stamp keying code numbers on keys and cylinders.

.4 Supply construction cores.

.5 Hand over permanent cores and keys to Departmental Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply metal and aluminum door and frame manufacturers with complete instructions and templates for preparation of their Work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Use only manufacturer's supplied fasteners.
.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.7 Remove construction cores when directed by Departmental Representative.
.1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.
.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
.3 Remove protective Material from hardware items where present.
.4 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.2 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.4 DEMONSTRATION

.1 Maintenance Staff Briefing:
.1 Brief maintenance staff regarding:
.1 Proper care, cleaning, and general maintenance of projects complete hardware.
.2 Description, use, handling, and storage of keys.
.3 Use, application and storage of wrenches for door closers and locksets.

.2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by door hardware installation.

3.6 SCHEDULE

.1 See attached schedule.

END

Port Weller Department of Fisheries and Oceans Search & Rescue Station

Hardware Group No. 01

For use on Door #(s):
D100A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
1	EA	CONT. HINGE	A31011G/A31021G
1	EA	PANIC HARDWARE	Grade 1, Type 4, Function 03
1	EA	RIM CYLINDER	TO SUIT (E09221)
1	EA	90 DEG OFFSET PULL	8190EZHD 255MM STD
1	EA	OH STOP	HEAVY DUTY CONCEALED (C01541)
1	EA	SURF. AUTO OPERATOR	ANSI/BHMA A156.19-2013
2	EA	ACTUATOR 150 x 150	ANSI/BHMA A156.19-2013
2	EA	ESCUTCHEON	ANSI/BHMA A156.19-2013
2	EA	BOLLARD	TO SUIT ACTUATOR
1	EA	GASKETING	1 X W, 2 X H
1	EA	DOOR SWEEP	1 X W
1	EA	THRESHOLD	1 X W

Hardware Group No. 02

For use on Door #(s):
D101
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
1	EA	MORTISE CYLINDER	TO SUIT
1	EA	HARDWARE	ALL HARDWARE BY DOOR SUPPLIER

Hardware Group No. 03

For use on Door #(s):
D100B
Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
1	EA	POCKET DOOR KIT	ANSI/BHMA A156.14-2013
2	EA	FLUSH PULL	

Port Weller Department of Fisheries and Oceans Search & Rescue Station

Hardware Group No. 04

For use on Door #(s):
D104
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	A8112 (A112)
1	EA	CLASSROOM LOCK	F84 (F84)
1	EA	1461 REG	ANSI/BHMA A156.4-2008
1	EA	KICK PLATE	(J102)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201

Hardware Group No. 05

For use on Door #(s):
D105A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	A8112 (A112)
1	EA	STOREROOM LOCK	F86 (F86)
1	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008
1	EA	KICK PLATE	(J102)
1	EA	SMOKE SEAL	1 X W, 2 X H

Hardware Group No. 06

For use on Door #(s):
D106
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
4	EA	HINGE	A8112 (A112)
1	EA	STOREROOM LOCK	F86 (F86)
1	EA	INTERFACE BOX	JUNCTION BOX
1	EA	ELECTRIC STRIKE	ANSI/BHMA A156.31 (A156.31, Grade 1)
1	EA	SURF. AUTO OPERATOR	ANSI/BHMA A156.19-2013
2	EA	ACTUATOR 150 x 150	ANSI/BHMA A156.19-2013
2	EA	ESCUTCHEON	ANSI/BHMA A156.19-2013
1	EA	PUSH TO LOCK/ANNUNCIATOR	CM-AF550R
1	EA	KICK PLATE	8400 200MM X LDW (J102)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201
1	EA	ADVANCED LOGIC RELAY	CX-33
1	EA	EMERGENCY CALL KIT	CX-WEC10
1	EA	DOOR CONTACT	CONCEALED
1	EA	POWER SUPPLY	ANSI/UL 294

Port Weller Department of Fisheries and Oceans Search & Rescue Station

Hardware Group No. 07

For use on Door #(s):
D107
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	A8112 (A112)
1	EA	PRIVACY LOCK	F76 (F76)
1	EA	KICK PLATE	(J102)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201

Hardware Group No. 08

For use on Door #(s):
D110
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
6	EA	HINGE	A8112 (A112)
2	EA	MANUAL FLUSH BOLT	ANSI A156.16, L04261 (L04251)
1	EA	DUST PROOF STRIKE	ANSI/BHMA 156.16, L14011. (L14011)
1	EA	STOREROOM LOCK	F86 (F86)
2	EA	OH STOP	MEDIUM DUTY SURFACE (C05541)

Hardware Group No. 09

For use on Door #(s):
D108 D109 D112 D113 D114
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	A8112 (A112)
1	EA	ENTRANCE LOCK	F109
1	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008 (C03011/C03041 PT-4A, PT-4C, PT4-D, PT-4H)
1	EA	KICK PLATE	(J102)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201
1	EA	DOOR SWEEP	BY CONTRACTOR
1	EA	THRESHOLD	BY CONTRACTOR
1	EA	VIEWER	ANSI/BHMA A156.16 L23222 (L23222)

Port Weller Department of Fisheries and Oceans Search & Rescue Station

Hardware Group No. 10

For use on Door #(s):
D115
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	A8112 (A112)
1	EA	STOREROOM LOCK	F86 (F86)
1	EA	1461 REG	ANSI/BHMA A156.4-2008
1	EA	KICK PLATE	(J102)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201
1	EA	SMOKE SEAL	1 X W, 2 X H

Hardware Group No. 11

For use on Door #(s):
D116
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	A8112 (A112)
1	EA	CLASSROOM LOCK	F84
1	EA	KICK PLATE	8400 200MM X LDW (J102)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201

Hardware Group No. 12

For use on Door #(s):
D200
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	SOURCE HERITAGE HARDWARE
1	EA	LOCKSET	SOURCE HERITAGE HARDWARE
1	EA	CYLINDER	TO SUIT
1	EA	OH STOP	HEAVY DUTY CONCEALED (C01541)
1	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008 (A156.4-2008)
1	EA	GASKETING	1 X W, 2 X H
1	EA	DOOR SWEEP	1 X W
1	EA	THRESHOLD	1 X W

NOTE: HERITAGE LOCKSET TO BE ANSI F13 CORRIDOR WITH HERITAGE STYLE TO SUITE EXISTING BUILDING

Port Weller Department of Fisheries and Oceans Search & Rescue Station

Hardware Group No. 13

For use on Door #(s):
D203 D205
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	BY FRAME SUPPLIER
1	EA	ENTRANCE/OFFICE LOCK	F109 (F82)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201 (L22251)

NOTE: EXTENDED STRIKE LIP NEEDED FOR DEMOUNTABLE PARTITION

Hardware Group No. 14

For use on Door #(s):
D204
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
4	EA	HINGE	A8112 (A8112)
1	EA	PRIVACY LOCK	F76 (F76)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201 (L22251)

Hardware Group No. 15

For use on Door #(s):
D300A
Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
1	EA	HARDWARE	ALL HARDWARE BY DOOR SUPPLIER

Hardware Group No. 16

For use on Door #(s):
D300B D300C
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
4	EA	HINGE	A8112 (A5112)
1	EA	CORRIDOR LOCK	F13 (F13)
1	EA	SURFACE CLOSER	ANSI/BHMA A156.19-2013 (C02061 PT-4A, PT-4C, PT-4D, PT-4G, PT-4H)
1	EA	KICK PLATE	(J102)
1	EA	GASKETING	1 X W, 2 X H
1	EA	DOOR SWEEP	1 X W
1	EA	THRESHOLD	1 X W

Port Weller Department of Fisheries and Oceans Search & Rescue Station

Hardware Group No. 17

For use on Door #(s):
D301
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	A8112 (A8112)
1	EA	STOREROOM LOCK	F86 (F86)
1	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008 (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)
1	EA	KICK PLATE	(J102)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201 (L22201)
1	EA	SMOKE SEAL	1 X W, 2 X H

Hardware Group No. 18

For use on Door #(s):
D303
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	A8112 (A8112)
1	EA	STOREROOM LOCK	F86 (F86)
1	EA	OH STOP	HEAVY DUTY SURFACE (C02541)
1	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008 (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)
1	EA	KICK PLATE	(J102)
1	EA	SMOKE SEAL	1 X W, 2 X H

Hardware Group No. 19

For use on Door #(s):
D302
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
4	EA	HINGE	A8112 (A8112)
1	EA	CLASSROOM LOCK	F84 (F84)
1	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008 (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)
1	EA	KICK PLATE	8400 200MM X LDW (J102)
1	EA	WALL STOP	ANSI/BHMA 156.16 L22201 (L22201)
1	EA	SMOKE SEAL	1 X W, 2 X H

Port Weller Department of Fisheries and Oceans Search & Rescue Station

Hardware Group No. 20

For use on Door #(s):
D108A D109A D112A D113A D114A
Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
2	EA	END CAP	ANSI/BHMA A156.14-2013
1	EA	FASCIA	ANSI/BHMA A156.14-2013
1	EA	BY-PASS TRACK	ANSI/BHMA A156.14-2013
2	EA	HOOK DEADBOLT	MS1850SN-050
2	EA	MORTISE CYLINDER	TO SUIT
2	EA	FLUSH PULL	

Hardware Group No. 21

For use on Door #(s):
D105B
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
6	EA	HINGE	A8112 (A112)
1	SET	CONST LATCHING BOLT	ANSI A156.3 TYPE 27 (TYPE 27)
1	EA	PASSAGE SET	F75 WITH FIRE LATCH
1	EA	COORDINATOR	ANSI/BHMA A156.3, TYPE 21 (TYPE 21)
2	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008
2	EA	MEETING STILE	2 X H
1	EA	SMOKE SEAL	1 X W, 2 X H

Hardware Group No. 22

For use on Door #(s):
D111 D117
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
6	EA	HINGE	A8112 (A112)
2	EA	SINGLE DUMMY TRIM	F170
2	EA	OH STOP	MEDIUM DUTY SURFACE (C05541)

Port Weller Department of Fisheries and Oceans Search & Rescue Station

Hardware Group No. 23

For use on Door #(s):
D118
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
1	EA	CONT. HINGE	A31011G/A31021G
1	EA	PANIC HARDWARE	Grade 1, Type 4, Function 03
1	EA	RIM CYLINDER	TO SUIT (E09221)
1	EA	90 DEG OFFSET PULL	8190EZHD 255MM STD
1	EA	OH STOP	HEAVY DUTY CONCEALED (C01541)
1	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008
1	EA	MOUNTING PLATE	TO SUIT DOOR CLOSER
1	EA	GASKETING	1 X W, 2 X H
1	EA	DOOR SWEEP	1 X W
1	EA	THRESHOLD	1 X W

Hardware Group No. 24

For use on Door #(s):
D202
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER
3	EA	HINGE	SOURCE HERITAGE HARDWARE
1	EA	LOCKSET	SOURCE HERITAGE HARDWARE
1	EA	CYLINDER	TO SUIT
1	EA	OH STOP	HEAVY DUTY CONCEALED (C01541)
1	EA	SURFACE CLOSER	ANSI/BHMA A156.4-2008 (A156.4-2008)
1	EA	SMOKE SEAL	1 X W, 2 X H

NOTE: HERITAGE LOCKSET TO BE ANSI F13 CORRIDOR WITH HERITAGE STYLE TO SUITE EXISTING BUILDING

Port Weller Department of Fisheries and Oceans Search Rescue Station

Door Numbers	HwSet#
D100A	01
D100B	03
D101	02
D104	04
D105A	05
D105B	21
D106	06
D107	07
D108	09
D108A	20
D109	09
D109A	20
D110	08
D111	22
D112	09
D112A	20
D113	09
D113A	20
D114	09
D114A	20
D115	10
D116	11
D117	22
D118	23
D200	12
D202	24
D203	13
D204	14
D205	13
D300A	15
D300B	16
D300C	16
D301	17
D302	19
D303	18

PART 1 – GENERAL

1.1 WORK INCLUDED

.1 Provide labour, Material, equipment, and tools to design and install swing door operators.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
.1 ANSI/BHMA-A156.10-2017, Power Operated Pedestrian Doors (for definition of terms used in A156.19).
.2 ANSI/BHMA-A156.19-2013, Power Assist and Low Energy Power-Operated Doors.

.2 Canadian Standards Association (CSA):
.1 CSA B651-18, Accessible Design for the Built Environment.

.3 National Fire Prevention Association (NFPA):
.1 NFPA 80-2019, Standard for Fire Doors and Other Opening Protectives.

1.3 DESIGN REQUIREMENTS

.1 Design handicap door system comprising of low energy power operator with optional push and go door system as defined in ANSI/BHMA A156.19.

1.4 SUBMITTALS

.1 Submit one copy of product data sheets in accordance with Sections 01 33 00 and 01 78 00 for each item specified below.

.2 Product data sheets shall consist of catalogue cuts, product number, manufacturer's name and phone number, finish and reference identification to specified standard.
.1 Where data sheets list multiple models or configurations on the same sheet, indicate which model is proposed.

.3 Submit data sheets indicating that operator conforms with all the requirements of ANSI/BHMA-A156.19. Highlight the following data:
.1 Opening and closing speeds are adjustable in accordance with requirements of Table 1.
.2 Doors require a force of not more than 67 N to open or stop door movement.
.3 Door operator acts as a normal door closer in the event of power loss. Manual resistance not to exceed limits stated.
.4 The kinetic energy of the door controlled by this operator does not exceed 1.69 Nm.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 Comply with design and signage requirements of CSA B651.

.2 Comply with the performance requirements of ANSI/BHMA-A156.19.

.3 Comply with the requirements of NFPA 80, for interconnection of control and activation circuits with the building Fire Alarm system.

.4 Provide ULC or cUL labelled units and hardware in Fire Separations.

1.6 EXTENDED WARRANTY

.1 For the Work in this Section 08 71 12 the standard warranty period of 12 months listed in GC3.13 of General Conditions is extended to 36 months.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 In-header operator: ULC or cUL approved, completely contained in the door header requiring only electric, pneumatic or hydraulic power, sealed against dust and moisture. Complying with design requirements of ANSI/BHMA-A156.19, Power Assist and Low Energy Power Operated Doors.
- .1 Operator housing: aluminum, maximum size 152 x 152 mm x door width, clear anodized, minimum wall thickness 4 mm.
- .2 Electric motor: 5 amp maximum, 120V, Built-in thermal overload protection and automatic re-set.
- .3 Electronic control:
  - .1 Self-contained, solid state integrated circuit for controlling the operations and switching of the door operator.
  - .2 Provide low voltage power supply for all means of actuation.
  - .3 Provide adjustable time delay of 1 to 60 seconds.
- .4 Single acting operation:
  - .1 Maintain constant opening pressure.
  - .2 Provide individual adjustment for opening and closing speeds and variable time delay. Provide separate adjustable creep speed/latch speed features on closing.
  - .3 Provide manual door closer function in the event of power failure.
  - .4 Force required for manual door operation is independent of opening speed setting.
  - .5 Provide closing function that overcomes air pressure differences and returns door to full close and latch.
  - .6 Provide recycle operation from any intermediate door position.
- .5 Time delay circuit:
  - .1 Provide time delay operation to allow electric strike to release prior to initiating opening cycle.

.6 Activating devices:
.1 Provide controls that cause door to open instantly when device located on approach side of door is actuated; hold door in open position, and cause door to close - unless re-actuation of opening impulse overrides such operation.
.2 Provide the following actuating devices:
.1 Press wall or jamb mount switches, 2 per door: wheelchair logo, colour blue, stainless steel, weatherproof at exterior locations.

.2 Power supply: ULC approved, rated for and compatible with electric latch retraction exit device or electric strike.

.3 Key switch: rated for and compatible with Exit Device.

.4 Accessories: signage required by ANSI, stainless steel plate press buttons.

PART 3 – EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for door operator installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install swing door operator in accordance with manufacturer's recommendations using factory authorized and trained personnel.

.2 Coordinate with applicable door Sections as required for Work of this Section.

.3 Installation of automatic door operators to be in accordance with requirements of the National Building Code of Canada (NBC).

.4 Install wall switches at 900 - 1000 mm above floor and in door jambs as required for the project.

.5 Power supply to each door operator and wiring shall be provided by Division 26. Make connections at operators and at control panel and supply and install each electrical Work between operators and activating controls. Comply with requirements of Division 26. All wiring shall be concealed and where exposed shall be run in conduit. Location of exposed wiring shall be subject to Departmental Representative’s approval.

.6 Conceal fasteners.

.7 Field adjust opening and closing times in accordance with Table 1, ANSI/BHMA-A156.19 to ensure smooth and proper operation.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

3.5 HARDWARE SCHEDULE

.1 Refer to Hardware Schedule appended to Section 08 71 11 and Contract Drawings for doors requiring Power Door Operators.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
- .1 ASTM C920-18, Specification for Elastomeric Joint Sealants.
- .2 ASTM D2240-15el, Test Method for Rubber Property - Durometer Hardness.
- .3 ASTM E2190-19, Standard Specification for Insulating Glass Unit Performance and Evaluation.

.2 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-12.1-2017, Safety Glazing.
- .2 CAN/CGSB-12.8-2017, Insulating Glass Units.

.3 Glass Association of North America (GANA).
- .1 GANA Glazing Manual (50th Anniversary Edition)-2008.

.4 Insulated Glass Manufacturers Association of Canada (IGMA).

.4 National Fire Protection Association (NFPA).
- .1 NFPA 80-2019, Standard for Fire Doors and Other Opening Protectives.

.5 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
- .2 CAN/ULC-S106-15, Standard Method for Fire Tests of Window and Glass Block Assemblies.

1.2 DESIGN REQUIREMENTS

.1 Glass design:
- .1 Design glass using a probability of breakage of 8 lites per 1000 at the first application of design load.
- .2 Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, handling, transportation, and erection loads.
- .3 Perform a thermal stress analysis on each glass unit with Low-E coating and provide heat strengthening and/or tempered units as necessary to prevent thermal breakage.
- .4 Perform a thermal stress analysis on each insulating thermal unit and provide heat strengthening and/or tempered units as necessary to prevent thermal breakage.
- .5 Where required, design glazing units so as not to allow thermal stress fracture due to heat build-up behind insulating units.
- .6 Coordinate with applicable Sections as required to meet intended energy and performance requirements for insulating glass units.

.2 Structural glazing:
- .1 Carry out design of structural silicone joints by rational analysis including all movements specified herein. Maximum stress shall not exceed 138 kPa (20 psi) in tension or shear for short term loading. Maximum stress in shear for long term loading due to the dead load of glass shall not exceed 7 kPa (1 psi) or the limit imposed by sealant manufacturer, whichever is less.

.2 The joint shall be essentially rectangular in shape and shall include no internal corners which could precipitate tearing or create high local stresses.

.3 Single Source Responsibility for Sealants, Gaskets and Other Glazing Accessories: In order to ensure consistent quality of performance, provide all glazing sealants and seals from a single manufacturer.

.4 Preconstruction Compatibility and Adhesion Testing: Submit to sealant manufacturer, samples of each glass, gasket, glazing accessory and glass-framing member that will contact or affect glazing sealants for compatibility and adhesion testing. Schedule submission of test samples to provide sufficient time for testing and analysis of results to prevent delay in the progress of work.

.3 Limit glass deflection to flexural limit of glass with full recovery of glazing Materials.

.4 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.5 Design IGU and framing systems to meet performance requirements as specified and shown on Contract Drawings.

.6 Design double glazed units as part of a complete window system meeting the Design Requirements specified herein and in Sections 08 44 13, 08 51 13, and 08 51 23. Design structural silicone glazing system as part of the work of Section 08 44 13.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings: Submit shop drawings indicating as a minimum:

.1 Fabrication and erection of glazing elements indicating Materials, thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.4 Samples:

.1 Submit duplicate 300 x 300 mm size samples of each type of glass and glass assembly, and sealant Material.

.2 Submit one representative sample each pattern and type of glazing film in accordance with Section 01 33 00.

.3 Approved sample may be installed as part of completed Work.

.3 Submit maintenance data for glazing film to Departmental Representative in accordance with Sections 01 77 00 and 01 78 00.

.5 Certificates: product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.6 Test Reports:
.1 certified test reports showing compliance with specified performance characteristics and physical properties.
.2 Submit compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.
.3 Compatibility test report from manufacturer of insulating glass edge sealant, indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, setting blocks, edge blocks and any other material that contacts or can affect the edge seal.

.7 Closeout submittals: Submit maintenance data for glazing Materials to Departmental Representative in accordance with Sections 01 77 00 and 01 78 00.

1.4 QUALITY ASSURANCE

.1 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 01 31 19.

.2 Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of ULC certifying it for use in tested and rated fire protective assemblies.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect glazing and frames from nicks, scratches, and blemishes.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.6 SITE CONDITIONS

.1 Environmental Requirements:
.1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.
.2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 EXTENDED WARRANTY

.1 In accordance with Section 08 44 13, 08 51 13 and 08 51 23.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Tempered safety glass (TGL): to CAN/CGSB-12.1, Type 2-tempered, Class B, clear, minimum 6 mm thick.

.2 Laminated safety glass (LG):
.1 Laminated glass (LG1): to CAN/CGSB-12.1, Category II, consisting of two layers of minimum 3 mm thick clear tempered glass, sandwiching a 0.8 mm thick clear PVB interlayer. Total thickness of 6.8 mm.
.2 Laminated glass (LG2): to CAN/CGSB-12.1, Category II, consisting of two layers of minimum 6 mm thick clear tempered glass, sandwiching a 1.5 mm thick clear PVB interlayer. For use at glass partitions. Total thickness of 13.5 mm.

.3 Fire rated glass (FRGL)): 20 min. to 90 min. fire rating tested to CAN/ULC-S104 and CAN/ULC-S106, 5 mm thick or as otherwise noted on Contract Drawings with appropriate labelling stating fire rating and approval, clear polished glass.

.4 Insulating glass units:
.1 To CAN/CGSB-12.8 and IGMA requirements utilizing approved stainless steel edge spacer. Dual seal with a PIB primary seal and silicone secondary seal.
.2 To comply with IGMA labelling requirements to be considered certified. Materials, excluding the glass, shall be from the same manufacturer as those employed for the certification of the insulating glass units.

.5 Argon gas: 100% pure. Argon gas to be used to fill air space at all insulated glass units.

.6 Low E coating:
.1 Conforming to ASTM E2190, high performance sputtered low-E coating.
.2 Provide insulating glass units with low-E coating edge deletion and low-E coating.
.3 Apply low-E coating to second surfaces as required to meet performance characteristics.

.7 Glazing and rebate primers, sealants, sealers, and cleaners: Compatible with each other. Type as recommended by glass manufacturer.

.8 Glazing sealant: one-part silicone to ASTM C920, Type S, Grade NS, Class 50, SWRI validated. Verify compatibility with insulating glass unit secondary sealant.

.9 Structural silicone sealant: one-part silicone to ASTM C920, Type S or M, Grade NS, Class 25, SWRI validated.

.10 Setting blocks: Silicone setting blocks with Shore, Type A durometer hardness of 85, plus or minus 5 to ASTM D2240, sized to suit glazing method, glass unit weight and area.

.11 Edge blocks: EPDM, 60-70 Shore A Durometer hardness, self-adhesive on face, sized with 3 mm clearance from glass edge and spanning glass thickness(es).

.12 Glazing tape: preformed butyl with continuous spacer, Shore "A" 10-15 durometer hardness, paper release, black colour, 3 x 9.5 mm.

.13 Glazing tape (fire rated glass): Closed cell polyvinyl chloride (PVC) foam as recommended by fire rated glass manufacturer.

.14 Gasket: extruded composite glazing seal, size as recommended by manufacturer.

.15 Glass presence markers: Easily removable, non-residue depositing.

.16 Glass film: Decorative opaque plastic film; colours, patterns, and application patterns as indicated on Drawings.

.17 Screws, bolts and fasteners: Type 304 stainless steel.

2.2 GLAZING SCHEDULE

.1 General: Glass types shall be as indicated below unless otherwise required due to thermal stress analysis.

.2 Glass Type 1: Minimum 6.8 mm thick clear laminated glass (LG1) outside, argon filled air space, minimum 6 mm thick clear tempered glass (TGL) inside, complete with low E coating as required to meet intended performance characteristics. 26 mm overall nominal thickness. For use at exterior windows as indicated and exterior doors.

.3 Glass Type 2: Minimum 3.0 mm thick clear tempered glass (TGL) with low-e coating on second surface outside, argon filled 12.5 mm air space with warm edge spacers, 3.0 mm thick clear tempered glass (TGL) inside. For use at historic steel windows.

.4 Glass Type 3: Minimum 13.5 mm thick clear tempered/laminated glass, for use at glass partitions.

.5 Glass Type 4: Minimum 6.8 mm thick clear tempered/laminated glass, for use as safety glass vision panels in non-rated interior doors.

.7 Glass Type 5: Minimum 5 mm thick clear fire rated glass (FRGL) for use at interior glass lites in fire-rated doors and partitions.

2.3 FABRICATION

.1 Verify glazing dimensions on Site.

.2 Clearly label each glass lite with maker's name and glass type. Ensure labels are easily removable, non-residue depositing type. Do not remove labels until after Work is accepted by the Departmental Representative.

.3 Fabricate glazing not less than 3 mm smaller than rebate size in either dimension; allow for edge spacers, shims, and setting blocks as necessary.

.4 Work shall have smooth finished surfaces free from distortion and defects detrimental to appearance and performance.

.5 Carefully make and fit details. Take special care with exposed finished Work to produce a neat and correct appearance to the Departmental Representative's acceptance.

.6 Grind and polish a 1.5 mm arris to both edges of exposed glazing at locations where glazing is not encapsulated in framing and where edges are exposed to occupants.

.7 Fabricate argon filled thermal units with air space filled minimum 90% with argon gas.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

.1 Provide glazing in accordance with IGMA recommendations. Provide continuous contact between glazing tapes and gasket to the glazing.

.2 Install glazing in accordance with reviewed shop drawings and manufacturer's written instructions. Install glazing with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.

.3 Apply a continuous heel bead of sealant around perimeter of inboard lite of the sealed unit and the metal framing.

.4 Glass, general:
- .1 Clean and dry surfaces.
- .2 Apply glazing tape to fixed stops.
- .3 Place setting blocks at 1/3 points.
- .4 Set glass on setting blocks against tape.
- .5 Apply glazing tape to glass.
- .6 Install stops.
- .7 Apply sealant behind stop and tool to smooth surface.

.5 Provide neat, straight sight lines. Trim excess glazing tape flush with top of stops and fixed leg of frames.

.6 Remove, dispose of, and replace broken, cut, abraded glass, and defective glass including but not limited to production dimples, roller wave or marks, tong marks, chips, cracks, etc.

.7 Exterior glass: Glaze units with gasket on exterior side and glazing tape on interior side. Seal gap between glazing and stop with sealant to depth equal to bite of frame. Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

.8 Structural glazing: Glaze units in accordance with reviewed shop drawings and in accordance with manufacturer’s written instructions.

.9 Interior glass: Glaze interior glass using glazing gasket glazing tape.

.10 Fire rated glass:
- .1 Install fire rated glass in accordance with ULC and NFPA 80 requirements
- .2 Place setting blocks located at quarter points of glass with edge block no more than 150 mm from corners.
- .3 Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
- .4 Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described above.
- .6 Install removable stop and secure without displacement of tape.

.7 Install so that appropriate ULC markings remain permanently visible.

.11 Glass film:
.1 Install glass film with adhesive, applied in accordance with film manufacturer's instructions.
.2 Place without air bubbles, creases, or visible distortion.
.3 Fit tight to glass perimeter with razor cut edge.

3.4 CLEANING

.1 Immediately remove sealant and compound droppings from finished surfaces.

.2 Remove labels, protective Material, and glass presence markers from prefinished surfaces.

.3 Clean glass surfaces with cleaning agents and methods in accordance with manufacturer's written instructions.

.4 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.5 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.6 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

.7 Do not wash glass film for 30 days after installation.

.8 DO not use bristle brushes on glass film.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 After installation, mark each light with an "X" by using removable plastic tape or paste.

.3 Repair damage to adjacent Materials caused by glazing installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
.1 ASTM C473-19, Standard Test Methods for Physical Testing of Gypsum Panel Products.
.2 ASTM C475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
.3 ASTM C840-19b, Standard Specification for Application and Finishing of Gypsum Board.
.4 ASTM C1002-18, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
.5 ASTM C1047-14a(2019), Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
.6 ASTM C1280-18, Standard Specification for Application of Gypsum Sheathing.
.7 ASTM C1288-17, Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.
.8 ASTM C1325-19, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
.9 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
.10 ASTM D2394-17, Standard Test Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring.
.11 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
.12 ASTM E2638-10(2017), Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.

.2 Association of the Wall and Ceilings Industries International (AWCI)
.1 AWCI Levels of Gypsum Board Finish GA-214-2015.

.3 American National Standards Institute (ANSI)
.1 ANSI A118.9-2019, Test Methods and Specifications for Cementitious Backer Units.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DESIGN REQUIREMENTS

.1 Partition assembly to be non-combustible construction and fire resistance rated as indicated.

.2 Unless otherwise indicated, minimum sound transmission rating of installed partitions to be STC 32, tested to ASTM E90.

.3 Minimum speech privacy category SPC Enhanced Speech Privacy 65-70 tested to ASTM E2638.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store gypsum board assemblies Materials covered, level, off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
.3 Protect from weather, elements and damage from construction operations.
.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
.5 Replace defective or damaged Materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 20.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimumafter completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment Material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Standard board: to ASTM C1396/C1396M, minimum 40% recycled content, regular, 12.7 mm and 15.9 mm thick as indicted, fire-rated, 15.9 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges rounded.

.2 Water-resistant board: to ASTM C1396/C1396M with silicone in core, regular, 12.7 mm and 15.9 mm thick as indicated, fire-rated, 15.9 mm thick, 1200 mm wide x maximum practical length.

.3 Cement board for shower walls: cementitious, water durable, board; surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped; to ANSI A118.9, ASTM C1288 and ASTM C1325, 13 mm thick, edges tapered, 1200 mm wide x maximum practical length. Compressive strength: Not less than 15.51 MPa when tested in accordance with ASTM D2394. Water absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C473.

.4 Metal furring runners, hangers, tie wires, inserts, anchors, etc.: to ASTM C645.

.5 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.6 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.7 Steel drill screws: to ASTM C1002.

.8 Laminating compound: as recommended by manufacturer, asbestos-free.

.9 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.10 Shadow mould: 35 mm high, snap-on trim, of 0.6 mm base steel thickness galvanized sheet pre-finished in satin enamel, white colour.

.11 Sealants: in accordance with Section 07 92 00.

.12 Joint compound: to ASTM C475/C475M, asbestos-free.

.13 Joint tape: to ASTM C475/C475M.
.1 Paper tape for standard gypsum board.
.2 Glass mesh tape for water resistent gypsum board and cement board.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 ERECTION

.1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.

.2 Do application of gypsum sheathing to ASTM C1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.13 Erect drywall resilient furring transversely across studs, joists, between the layers of gypsum board, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical Work have been approved.

.2 Apply single layer, unless indicated otherwise, gypsum board to metal furring or framing using screw fasteners for first layer, laminating adhesive and screw fasteners for second layer. Maximum spacing of screws 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings prior to application of walls to ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Apply water-resistant gypsum board where indicated. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

.4 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.

.5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.7 Install gypsum board with face side out.

.8 Do not install damaged or damp boards.

.9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre using contact adhesive for full length.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.

.6 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.7 Locate control joints where indicated, at changes in substrate construction, at approximate 10 m spacing on long corridor runs, and at approximate 15 m spacing on ceilings.

.8 Install control joints straight and true.

.9 Install access doors to electrical and mechanical fixtures specified in respective sections.
.1 Rigidly secure frames to furring or framing systems.

.10 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.11 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI GA-214 Levels of Gypsum Board Finish:
.1 Levels of finish:
.1 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.12 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.13 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.14 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.15 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.
.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.2 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by gypsum board assemblies installation.

END

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards (ANSI) for the Installation of Ceramic Tile/Ceramic Tile Institute of America (CTIOA).
- .1 ANSI A108/A118/A136.1-2019, Installation of Ceramic Tile.
  - .1 ANSI A108.1A, Installation of Ceramic Tile in Wet-Set Method, with Portland Cement Mortar.
  - .2 ANSI A108.5, Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
  - .3 ANSI A118.1, Dry-Set Portland Cement Mortar.
  - .4 ANSI A118.3, Chemical Resistant Water Cleanable Tile-Setting and Grouting Epoxy and Water cleanable tile Setting Epoxy Adhesive.
  - .5 ANSI A118.4, Latex Portland Cement Mortar.
- .2 ANSI A137.1-2019, Specifications for Ceramic Tile.

.2 International Standards Organization (ISO).
- .1 ISO 13007-Part 1:2014: Ceramic tiles — Grouts and adhesives — Part 1: Terms, definitions and specifications for adhesives
- .2 ISO 13007-Part 2:2013: Ceramic tiles - Grouts and adhesives - Part 2: Test methods for adhesives
- .3 ISO 13007-Part 3:2010: Ceramic tiles - Grouts and adhesives - Part 3: Terms, definitions and specifications for grouts.
- .4 ISO 13007-Part 4:2013: Ceramic tiles - Grouts and adhesives - Part 4: Test methods for grouts.

.3 American Society for Testing and Materials International (ASTM).
- .1 ASTM C207-18, Standard Specification for Hydrated Lime for Masonry Purposes.

.4 Canadian Standards Association (CSA International).
- .1 CSA A3001-18, Cementitious Materials for Use in Concrete.
- .2 CAN/CSA-A179-14(R2019), Mortar and Grout for Unit Masonry.

.5 Terrazzo Tile and Marble Association of Canada (TTMAC).
- .1 Hard Surface Maintenance Guide.
- .2 TTMAC Specification Guide 09 30 00 - Tile Installation Manual 2019-2021.

.6 Tile Council of North America (TCNA).
- .1 Handbook for Ceramic, Glass and Stone Tile Installation, 2014.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Provide product data in accordance with Section 01 33 00.
- .1 Include manufacturer's information on:
  - .1 Each tile, marked to show each type, size, and shape required.
  - .2 Mortar and grout.
  - .3 Divider and edge protection strips.
  - .4 Reinforcing tape.

.5 Levelling compound.
.6 Waterproofing isolation membrane.
.7 Manufacturer's Instructions: manufacturer's installation instructions.

.3 Provide samples in accordance with Section 01 33 00.
.1 Duplicate full size samples of each colour, texture, size, and pattern of tiles.
.2 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.
.3 Adhere tile samples to plywood and grout joints to represent project installation.

.4 Submit TTMAC Installation Detail No. or Tile Council of America Installation Detail No. or shop drawing showing installation for each tile specified.

.5 Submit list of Materials suitable for sealing and finishing each tile specified.

.6 Certificates: Submit manufacturer's certificates stating that Materials supplied are in accordance with this specification.

.7 Closeout submittals: Submit recommended maintenance instructions and listing of recommended maintenance products for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.3 QUALITY ASSURANCE

.1 Use installation and grouting Materials produced by a manufacturer that has been regularly engaged in producing these Materials for a minimum of 10 years and has completed a minimum of 5 successful installations of this type, each at least five years old.

.2 Employ workmen with previous experience of more than 5 years in each different assembly specified.

.3 Provide references of 3 installations of similar type and size more than 3 years old for each assembly.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle Materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal:
.1 Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 15 degrees C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install tiles at temperatures less than 15 degrees C or above 45 degrees C.

1.6 MAINTENANCE

.1 Extra Materials:
.1 Provide maintenance Materials in accordance with Section 01 78 00.
.2 Provide minimum 3% of each type and colour of tile required for project for maintenance use. Store where directed.
.3 Maintenance Material same production run as installed Material.
.4 Store maintenance products as directed by the Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Ceramic floor, wall and tile base (CT):
.1 Conforming to ANSI A137.1.
.2 Floor tile to have a Wet Dynamic Coefficient of Friction (DCOF) of 0.61 or better.
.3 Supply coves, caps, inside and outside corners and bullnose tile as required.
.4 Base: Base tile to match floor tile, height and profile as indicated.
.5 Tile types: Refer to Interior Finish Schedule for tile types, colours, finishes and sizes for Work of this Section.

.2 Portland cement: to CSA A3001, type GU Normal, white at grout.

.3 Sand: to CAN/CSA-A179.

.4 Hydrated Lime: to ASTM C207.

.5 Latex: formulated for use in cement mortar.

.6 Water: potable.

.7 Waterproofing membrane: Self curing, liquid rubber polymer sheet with anti-fracture reinforcing fabric.

.8 Thin set bond coat (interior): dry set mortar, pre-mixed, thin set mortar formulated with Portland cement, sand and latex additive. Complying with ANSI A118.4 and ISO 13007.

.9 Epoxy grout: to ANSI A108.1, non-sag additive for Work on vertical surfaces, Epoxy grout Material shall be non-toxic, low odour, water cleanable and stain resistant. Colour to match tile colour.

.10 Transition strips: Stainless steel edge protection, continuous at all exposed tile edges, depth as required to suit tile thickness.

.11 Edge trims: Aluminum edge with satin anodized finish, continuous at all exposed tile edges, depth as required to suit tile thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for tile installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 SURFACE PREPARATION

.1 Do not proceed with installation unless substrate is structurally sound, solid and well fastened.

.2 New concrete: properly cured and designed with proper expansion and control joints.

.3 Surfaces must be clean and free from dust, dirt, oil, grease, paint, wax, sealers, curing compounds or any other substances which may reduce or prevent adhesion.

3.4 SYSTEM REQUIREMENTS

.1 Provide assemblies composed of compatible Materials from the same manufacturer.

.2 The completed assembly will meet the service requirements Heavy Duty described in Handbook For Ceramic Tile Installation.

.3 Use waterproof membrane for shower locations.

3.5 MIXING

.1 To ANSI A108.1A.

.2 Levelling coat (by volume):
.1 1 part portland cement.
.2 4 parts sand.
.3 1/10 part latex.
.4 1 part water (includes latex additive).
.5 Adjust water volume to suit water content of sand.

.3 Wall, mortar bed (by volume):
.1 1 part portland cement.
.2 1/5 to 1/2 parts hydrated lime.
.3 4 parts sand.
.4 1 part water.
.5 Adjust water volume to suit water content of sand.
.6 Latex, volume recommended by manufacturer.

.4 Floor, mortar bed (by volume):
.1 1 part portland cement.
.2 4 parts sand.
.3 1 part water.
.4 Adjust water volume to suit water and content of sand.
.5 Latex, volume recommended by manufacturer.

.5 Thin set bond coat and epoxy grout: dry set mortar; mix to manufacturer's instructions.

3.6 WORKMANSHIP

.1 Minimum surface and air temperature 12°C, before and during application and during curing period.

.2 Provide back-buttering in addition to the usual notch-trowel-applied bond coat in the following applications:
.1 With rib-backed tiles and heavy lug-backed tiles.
.2 In hot, dry or windy weather or where notched mortar bed was prepared too far in advance.

.3 Backbuttering: remove residual dust, wipe the back of the tile with a damp cloth or sponge, apply a full coverage 2 mm thick coat of mortar, apply no more than 10-15 minutes before tiles are set so that both back-butter and mortar are wet at time of setting.

.4 Use Box Screed jig with large sized tiles which are not of uniform thickness.

.5 Trowel in one direction and press the tile into the mortar with a sliding motion perpendicular to the trowel ridges. Twist, vibrate or beat the tiles to compress the trowel ridges to comply with requirements of ANSI A108.5.

.6 Perimeter tile minimum 1/2 size.

.7 Cut tile around corners and built-in objects smooth, even, chip and split free.

.8 Accurately form intersections, corners and returns.

.9 Joints uniform:
.1 Walls: 1.5-3.0 mm wide.
.2 Ceramic floor tiles: 3.0-6.0 mm wide.

.10 Surfaces plumb, straight, true, even and flush to a tolerance of 1:1000.

.11 Replace broken or hollow sounding tile.

.12 Allow 24 hours before grouting.

.13 Fill joints solid with grout, free of voids, cracks, excess mortar or grout.

.14 Clean surfaces after curing.

.15 Floors traffic free for 48 hours.

.16 Seal and finish floors in accordance with manufacturer's recommendations.

3.7 SETTING BACK-BUTTERED TILE

.1 Firmly push, twist and immediately beat or vibrate the tiles or stone units.

3.8 FLOOR TILE

.1 Install in accordance with:
.1 TTMAC detail 311F Detail A Interior/Exterior.
.2 Bond coat and epoxy grout manufacturer's written instructions.

3.9 WALL TILE

.1 Install in accordance with:
.1 TTMAC details 305W Detail A Interior Wet/Dry Areas and Exterior Use, Tile Installed on Cementitious Backer Unit (CBU) Thin Set Method/Walls.
.2 Bond coat and epoxy grout manufacturer's written instructions.

3.10 EXPANSION AND CONTROL JOINTS

.1 Provide control, expansion and isolation joints in accordance with TTMAC specification 301MJ and as indicated on drawings. Install in locations indicated on drawings, in accordance with joint manufacturer's recommendations and as follows:
.1 Interior: 4.8 m to 6 m each direction.
.2 Interior exposed to sunlight or moisture: 3.659 m to 4.878 m in both directions.
.3 Exterior: 2.439 m to 3.659 m in both directions.
.4 Where tile abutts restraining surfaces (walls, dissimilar floors, curbs, columns, pipes, ceilings and where changes occur in backing Materials.

.2 Provide expansion joints where tile spans cold joints, construction joints, saw-cuts and seismic joints.

.3 Construct during installation of mortar beds and/or tile, rather than saw-cutting joints after installation.

3.11 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.12 PROTECTION

.1 Protect tiled assemblies after final installation.

.2 Prevent direct impact, vibration and heavy hammering on adjacent and opposite walls for 24 hours minimum, after final installation.

.3 Cover Work temporarily with building paper properly lapped and taped at joints until Work has been approved by Departmental Representative.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
.1 ASTM D2047-17, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
.2 ASTM D2240-15e1, Standard Test Method for Rubber Property—Durometer Hardness.
.3 ASTM D2859-16, Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
.4 ASTM D3389-16, Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader).
.5 ASTM E492, Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
.6 ASTM E989, Standard Classification for Determination of Impact Insulation Class.
.7 ASTM F150-06(2018), Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
.8 ASTM F925-13, Standard Test Method for Resistance to Chemicals of Resilient Flooring.
.9 ASTM F970-17, Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
.10 ASTM F1700, Standard Specification for Solid Vinyl Floor Tile.
.11 ASTM F1861-16, Specification for Resilient Wall Base.
.12 ASTM F2170-19a, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

.2 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S102.2:2018, Standard Method of Test For Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for resilient flooring and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings: Submit shop drawings indicating seam layout.

.4 Samples:
.1 Submit duplicate 300 x 300 mm sample pieces of each type of flooring Material, 300 mm long base, and edge strips.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect specified Materials from damage.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.4 SITE CONDITIONS

.1 Ambient Conditions:
.1 Maintain air temperature and structural base temperature at flooring installation area above 18 degrees for 48 hours before, during and 48 hours after installation.

.2 Store Materials for 2 days prior to installation in area of Work to achieve temperature stability.

.3 Do not lay flooring in conditions of high humidity or where exposed to cold drafts. In hot weather, protect from direct sunlight.

.4 Do not install floor system until concrete has been cured sixty (60) days.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Rubber sheet flooring (RF):
.1 Minimum 6.5 mm thick rubber sheet flooring, manufactured from a composition of recycled truck tire crumb rubber encapsulated in a urethane binder.
.2 Rubber sheet flooring to meet the following minimum criteria:
.1 Hardness: ASTM D2240, 65 Shore A.
.2 Slip resistance: ASTM D2047, exceeds Federal Standards and ADA requirements for slip-resistance.
.3 Static Load Limit: ASTM F970, passes at 250 PSI.
.4 Abrasion: ASTM D3389, <1.00 gram weight loss.
.5 Flammability: ASTM D2859 Pill Test, passes with greater than 25 mm of un-charred area.
.6 Chemical resistance: ASTM F925 – 5% Acetic Acid, 70% Isopropyl Alcohol, 5% Sodium Hydroxide, 5% Hydrochloric Acid, 5% Ammonia, Bleach, 5% Phenol, and Sulfuric Acid.
.3 Refer to Interior Finish Schedule for rubber flooring type and colour.

.2 Static dissipative tile (SDT): To ASTM F1700, Class 1 Monolithic, Type A smooth surface, asbestos free, minimum 3.178 mm thick, with integral static dissipative element providing continuous static dissipation from tile to tile. Static dissipative tile system to include SDT, SDT adhesive, SDT copper grounding strips, and SDT polish.
.1 Tested in accordance with ASTM F150:
.1 Static Propensity: less than 2 kV with conductive footwear per AATCC-134, at 20% relative humidity.
.2 Static decay: 5,000 volts to zero in less than 0.01 seconds per US Federal Test Method 101B, Method 4048 at 15% relative humidity.
.3 Electrical resistance: equal to or greater than 1 MOhms ($>10^6$ Ohms) & equal to or less than 1,000 MOhms ($>10^9$ Ohms).
.2 Flame spread: 19 to CAN/ULC-S102.2.
.3 Smoke developed: 38 to CAN/ULC-S102.2.
.4 Grounding: 13 mm wide copper foil tape.
.5 Colour: Refer to Interior Finish Schedule for static dissipative tile type and colour.

.3 Luxury solid vinyl tile (LSVT): A layered construction consisting of a clear, vinyl wear layer protecting a high-fidelity print layer on a solid vinyl backing. Protected by a diamond-infused UV-cured polyurethane finish, wear surface is embossed with different textures to enhance each of the printed visuals. Colors are insoluble in water and resistant to cleaning agents and light.
.1 To ASTM F1700, Class III printed film, Type B embossed surface, asbestos free, minimum 5 mm thick.
.2 Pattern and Color: color to be selected from Manufacturer's full colour range.
.2 Sizes: 914.4 mm x 914.4 mm; 228.6 mm x 1498.6 mm; 177.8 mm x 1498.6 mm.
.3 Thickness: Minimum 5 mm thick with 0.5 mm wear layer, double reinforced base layer and non-skid acoustic backing.

.4 Resilient base (RB): ASTM F1861, Type TP, Group 1, continuous, in lengths as long as possible including premoulded end stops and inner and outer corners.
.1 Type: rubber.
.2 Style: straight.
.3 Thickness: 3.2 mm.
.4 Height: 153 mm.
.5 Colour: Refer to Interior Finish Schedule for rubber base colour.

.5 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific Material on applicable substrate, above, on or below grade.
.1 Floor adhesives:
.1 Adhesive: maximum VOC limit 60 g/L.
.2 Base adhesives:
.1 Adhesive: maximum VOC limit 50 g/L.

.6 Static dissipative tile adhesive: water based, low VOC and type recommended by flooring manufacturer.

.7 Sub-floor filler and leveler: white premix latex requiring water only to produce cementitious paste.

.8 Metal edge strips:
.1 Stainless steel extruded, smooth, stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.9 Edging to floor penetrations: stainless steel type recommended by flooring manufacturer.

.10 Static dissipative tile polish: type recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for resilient flooring installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 SITE VERIFICATION OF CONDITIONS

.1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.3 PREPARATION

.1 Prepare concrete substrates in accordance with manufacturer’s written instructions and to meet requirements of ASTM F970 and ASTM F2170.

.2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.3 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.4 Prime concrete slab to resilient flooring manufacturer's printed instructions.

3.4 APPLICATION: FLOORING

.1 Install resilient flooring on top of substrate in accordance with reviewed shop drawings and manufacturer’s written instructions.

.2 Install flooring into freshly applied adhesive ensuring that all seams are in contact without compression.

.3 Cut flooring neatly around fixed objects.

.4 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.5 Continue flooring over areas which will be under built-in furniture.

.6 Roll flooring in both directions when complete.

.7 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.5 APPLICATION: BASE

.1 Install resilient base in accordance with manufacturer’s written instructions.

.2 Lay out base to keep number of joints at minimum.

.3 Clean substrate and prime with one coat of adhesive.

.4 Apply adhesive to back of base.

.5 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.6 Install straight and level to variation of 1:1000.

.7 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.8 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base Material for external corners of other angles.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.
.1 Clean flooring and base surfaces to flooring manufacturer's printed instructions.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.7 STATIC DISSIPATIVE TILE CLEANING AND POLISHING

.1 Clean, seal and polish static dissipative tiles to manufacturer's instructions.

3.8 PROTECTION

.1 Protect new floors from time of final set of adhesive until final inspection.

.2 Prohibit traffic on floor for 72 hours after installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
.1 ASTM C109/C109M-20b, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50-mm Cube Specimens).
.2 ASTM C156-17, Standard Test Method for Water Loss from a Mortar Specimen Through Liquid Membrane-Forming Curing Compounds for Concrete.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product data: Submit product data indicating:
.1 Two copies of manufacturer's Product data on characteristics, performance criteria, and limitations.
.2 Preparation, installation requirements and techniques, Product storage, and handling criteria.

.3 Reports: Submit samples indicating coating and final concrete finish.

.4 Reports: Submit manufacturer's acceptance of substrate prior to installation in writing. Submit verification of moisture content of floor prior to installation.

.5 Closeout submittals: Submit maintenance data for incorporation into manuals in accordance with Section 01 78 00.

1.3 QUALITY ASSURANCE

.1 Perform Work of this Section by a company that is approved by manufacturer. Submit to the Departmental Representative, applicator's current certificate of approval by the Material manufacturer as proof of compliance.

.2 Mock-up:
.1 Construct one 2 m^2. mock-up of floor sealer in location acceptable to the Departmental Representative.
.2 Arrange for the Departmental Representative's review and acceptance, allow 48 hours after acceptance before proceeding with Work.
.3 Mock-up may remain as part of Work if accepted by Departmental Representative. If sealer application is unacceptable to Departmental Representative, rework sealer in accordance with manufacturer's recommendations to provide a sealed concrete surface acceptable to Departmental Representative.
.4 Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the Work of this Section.

.3 Pre-installation meetings: Arrange with manufacturer's representative and the Departmental Representative to inspect substrates, and to review Mock-up and installation procedures 48 hours in advance of installation.

1.4 SITE CONDITIONS

.1 Do not install the Work of this Section outside of environmental ranges as recommended by the manufacturer without Product manufacturer's written acceptance.

.2 Install temporary protection and facilities to maintain the Product manufacturer's, and the above specification, environmental requirements for 24 hours before, during, and 24 h after installation.

.3 Post do not enter and appropriate warning signs at conspicuous locations.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Each Material used in the application of each flooring system shall be as recommended or manufactured by the Supplier of the flooring system.

.2 Concrete floor sealer (CONC): Alkali-silicate, water-soluble, inorganic concrete hardener and dustproofer, meeting the following criteria:
.1 Compressive strength: ASTM C109/C109M, 41.4 MPa.
.2 Moisture retention: ASTM C156, 63 gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Prepare substrate in accordance with manufacturer's written instructions. Diamond grind and vacuum substrate free of debris and dust.

3.3 APPLICATION

.1 Apply concrete floor sealer in accordance with manufacturer's written instructions.

.2 Spray apply concrete sealer to entire surface and keep from drying for 30 minutes as recommended by manufacturer.

.3 Sprinkle surface with water as sealer begins to penetrate (after 30 minutes).

.4 Flush surface with water and drying begins to remove excess Material. Allow to harden for 24 hours.

.5 Lightly buff floor with a commercial floor buffer and non-aggressive pad to bring up required sheen.

.6 Apply second coat of concrete sealer following same procedures as first layer.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.5 PROTECTION

.1 Erect barriers to prevent the entry and presence of personnel not performing Work of this Section during application of floor sealer, and for 48 hours following completion of application.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Safety Data Sheets (SDS).

.2 The Master Painters Institute (MPI).
.1 Architectural Painting Specification Manual - 2020 plus amendments.
.2 Standard GPS-1-12, MPI Green Performance Standard for Painting and Coatings.

.3 National Fire Code of Canada, 2015 (NFC).

1.2 PERFORMANCE REQUIREMENTS

.1 Environmental Performance Requirements:
.1 Provide paint products meeting MPI "Environmentally Friendly" minimum E2 rating based on VOC (EPA Method 24) content levels.

.2 Green Performance in accordance with MPI Standard GPS-1.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit WHMIS SDS - Safety Data Sheets.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
.1 Product name, type and use.
.2 Manufacturer's product number.
.3 Colour numbers.
.4 MPI Environmentally Friendly classification system rating.
.5 Manufacturer's Safety Data Sheets (SDS).

.4 Samples: Provide samples in accordance with Section 01 33 00.
.1 Submit duplicate 300 x 300 mm sample panels of each paint finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
.1 3 mm plate steel for finishes over metal surfaces.
.2 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
.3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
.2 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

.3 Submit full range of available colours where colour availability is restricted.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 Contractor: to have a minimum of five years proven satisfactory experience. When requested, provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
.2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting Work.
.3 Apprentices: may be employed provided they Work under direct supervision of qualified journeyperson in accordance with trade regulations.

.2 Conform to latest MPI requirements for painting Work including preparation and priming.

.3 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

.4 Paint Materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating Materials as required.

.5 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

.6 Standard of Acceptance:
.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.
.2 Soffits and ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.7 Mock-up:
.1 Provide mock-up in accordance with Section 01 45 00.
.2 When requested by Departmental Representative or Paint Inspection Agency, prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site Work.

1.5 SCHEDULING OF WORK

.1 Submit Work schedule for various stages of painting to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for changes in Work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about building.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00, supplemented as follows:
.1 Deliver and store Materials in original containers, sealed, with labels intact.
.2 Labels: to indicate:
.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.
.3 Remove damaged, opened and rejected Materials from site.
.4 Provide and maintain dry, temperature controlled, secure storage.
.5 Observe manufacturer's recommendations for storage and handling.
.6 Store Materials and supplies away from heat generating devices.
.7 Store Materials and equipment in well ventilated area with temperature range meeting manufacturer’s recommendations.
.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.
.10 Remove paint Materials from storage only in quantities required for same day use.
.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous Materials.
.12 Fire Safety Requirements:
.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
.2 Store oily rags, waste products, empty containers and Materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
.3 Handle, store, use and dispose of flammable and combustible Materials in accordance with the National Fire Code of Canada.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Management and Disposal:
.1 Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.2 Paint, stain and wood preservative finishes and related Materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Ontario Ministry of the Environment, Conservation, and Parks and Regional levels of Government.

.3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
.4 Place Materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
.5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:
.1 Retain cleaning water for water-based Materials to allow sediments to be filtered out.
.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
.5 Empty paint cans are to be dry prior to disposal or recycling (where available).
.6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
.7 Set aside and protect surplus and uncontaminated finish Materials:
.8 Deliver to or arrange collection by organizations for verifiable re-use or re-manufacturing.
.9 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.8 AMBIENT CONDITIONS

.1 Heating, Ventilation and Lighting:
.1 Ventilate enclosed spaces in accordance with Section 01 51 00.
.2 Do not perform painting Work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
.3 Where required, provide continuous ventilation for seven days after completion of application of paint.
.4 Co-ordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
.6 Perform no painting Work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting Work when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 Relative humidity is above 85% or when dew point is less than 3 degrees C variance between air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting Work when maximum moisture content of substrate exceeds:

.1 12% for concrete and masonry (concrete block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

.9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.9 MAINTENANCE

.1 Extra Materials:
.1 Submit maintenance Materials in accordance with Section 01 78 00.

.2 Submit 1, one litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Unless specified otherwise, paint Materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint Materials for paint systems: to be products of single manufacturer.

.3 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:
.1 Be water soluble and water clean-up.
.2 Be non-flammable.
.3 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.
.4 Be manufactured without compounds which contribute to smog in the lower atmosphere.
.5 Do not contain methylene chloride, chlorinated hydrocarbons, or toxic metal pigments.

.4 Mineral based paint: Silicate dispersion paint, 96% natural minerals, odorless, VOC free, breathable, anti-microbial, mildew resistant, highly vapour permeable, non-combustible, opaque finish, and water repellent. Colour to later selection by Departmental Representative.

2.2 COLOURS

.1 Paint types and colours (PT): Refer to Interior Finish Schedule for selected colour references and paint types.

.2 Where specific products are available in restricted range of colours, selection will be based on limited range.

.3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting Materials is allowed only with Departmental Representative's written permission.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.

.4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high	> 85	

.2 Gloss level ratings of painted surfaces to be as indicated in Interior Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete Vertical Surfaces: including horizontal soffits
.1 INT 3.1C-G3 High performance architectural latex finish.

.2 Concrete Horizontal Surfaces: floors and stairs
.1 INT 3.2C-G6 Epoxy finish.

.3 Structural Steel and Metal Fabrications: columns, beams, joists, metal fabrications, etc.
.1 INT 5.1R-G3 High performance architectural latex finish.

.4 Galvanized Metal: doors, frames, misc. steel, pipes, overhead decking, ducts, etc.
.1 INT 5.3M-G5 High performance architectural latex finish.

.5 Dressed Lumber: including doors, door frames, casings, mouldings, etc.
.1 INT 6.3A-G5 High performance architectural latex finish.
.2 INT 6.3D-G5 Alkyd varnish finish (over stain).

.6 Plaster and Gypsum Board: gypsum wallboard, drywall, "sheet rock type Material", etc., and textured finishes
.1 INT 9.2B-G3 High performance architectural latex finish, for typical areas.
.2 INT 9.2F-G5 Waterborne epoxy (tile-like) finish, for wet areas.

2.6 EXTERIOR PAINTING SYSTEMS

.1 Concrete Vertical Surfaces: (including horizontal soffits)
.1 EXT 3.1B-G3/4 - Latex aggregate latex finish.

.2 Concrete surfaces at former light keepers dwelling:
.1 Primer: as recommended by mineral paint manufacturer.
.2 base coat: 1 coat mineral paint.
.3 Top coat: 1 coat mineral paint.

.3 Galvanized Metal:
.1 EXT 5.3C-G5 - Epoxy finish.

.4 Dressed Lumber: doors, etc.
.1 EXT 6.3G-G6 - Clear (2 component) polyurethane finish.
.2 EXT 6.3J-G5 – W.B. Light Industrial Coating. Colour: Red. At former light keepers dwelling.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Exterior and interior repainting Work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting Contractor to notify Paint Inspection Agency minimum of one week prior to commencement of Work and provide copy of project repainting specification and Finish Schedule.

.2 Exterior and interior surfaces requiring repainting: inspected by both painting Contractor and Paint Inspection Agency who will notify Departmental Representative in writing of defects or problems, prior to commencing repainting Work, or after surface preparation if unseen substrate damage is discovered.

.3 Where assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 PREPARATION

.1 Perform preparation and operations for painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.

.2 Apply paint Materials in accordance with paint manufacturer's written application instructions.

.3 Clean and prepare surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:
.1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
.2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
.4 Allow surfaces to drain completely and allow to dry thoroughly. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing Work.
.5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.
.6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.

.4 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.6 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

.7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.4 EXISTING CONDITIONS

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with Work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with Work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:
- .1 Plaster and Gypsum Board: 12%.
- .2 Concrete: 12%.
- .3 Concrete Block: 12%.
- .4 Wood: 15%.

3.5 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Departmental Representative.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians and building occupants in and about building.

.5 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.

.6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Departmental Representative.

3.6 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush, roller or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
- .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
- .2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Departmental Representative.
.5 Remove runs, sags and brush marks from finished Work and repaint.

.3 Spray Application:
.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
.4 Brush out immediately runs and sags.
.5 Use brushes to Work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Departmental Representative.

.5 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint exposed conduits, piping, hangers, duct Work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over nameplates.
.4 Paint fire protection piping in colour as indicated in Division 22.

.5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.8 FIELD QUALITY CONTROL

.1 Inspection:
.1 Field inspection of painting operations to be carried out be independent inspection firm as designated by Departmental Representative.
.2 Advise Departmental Representative when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
.3 Co-operate with inspection firm and provide access to areas of Work.
.2 Interior painting:
.1 Interior painting and decorating Work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of Work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting Work, or after prime coat shows defects in substrate.

.2 Manufacturer's Field Services:
.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 00.
.1 Remove paint where spilled, splashed, splattered or sprayed as Work progresses using means and Materials that are not detrimental to affected surfaces.

3.10 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Architectural Manufacturers Association (AAMA).
- .1 AAMA 611-14, Voluntary Specification for Anodized Architectural Aluminum.
- .2 Aluminum Association Designation System for Aluminum Finishes (AA)
  - .1 AA DAF 45-2003(R2009), Designation System for Aluminum Finishes

.2 American National Standards Institute (ANSI).
- .1 ANSI H35.1/H35.1M-17, Alloy and Temper Designation Systems for Aluminum (Metric).

.3 ASTM International (ASTM).
- .1 ASTM A653/A653M-20, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM B209M-14, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM B221M-13, Specification for Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.
- .4 ASTM C645-18, Standard Specification for Nonstructural Steel Framing Members.
- .5 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne - Sound Transmission Loss of Building Partitions, and Elements.
- .6 ASTM F738M-02(2008), Specification for Stainless Steel Metric Bolts, Screws, and Studs.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

1.2 DESIGN REQUIREMENTS

.1 Demountable partition system to be 100 mm wide, with flush joints, system components, door frames, glazed aluminum doors, glazed openings, and all trim components.

.2 Design partition system to provide an STC of 40 when tested in accordance with ASTM E90.

.3 Design partition system to allow for all panels to be point accessible without affecting adjoining panels.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature and data sheets for post and panel demountable partitions and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings: Submit shop drawings indicating location, construction, Adjacent construction, elevations, sections, panel sizes, interior structure and/or reinforcement, door and glazing modules, frame details, trim, connection to ceiling grid system, details, anchorages, dimensions, thickness, joints, and finishes.

.4 Samples:
.1 Two 300 x 300 mm samples of finishes applied to aluminum.
.2 Two 300 x 300 mm samples of wood veneer finish for swing doors.
.3 One 300 mm long sample of door frames, glazing framing, and trim.
.4 One 300 x 300 mm sample of glass.
.5 One of each component used in the partition system i.e. ceiling fixing device and other component parts.
.6 Samples to be reviewed and approved by Departmental Representative prior to ordering and installation.

.5 Test Reports:
.1 Submit test reports in accordance with Section 01 45 00, from approved independent testing laboratory, certifying partition system complies with sound transmission rating as specified.

1.4 QUALITY ASSURANCE

.1 Mock-Up:
.1 Construct mock-up in accordance with Section 01 45 00.
.2 Construct one full scale mock-up of a demountable partition.
.3 Locate where directed by the Departmental Representative.
.4 Mock-up may remain as part of finished Work if accepted by the Departmental Representative.
.5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with demountable partition Work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect post and panel demountable partitions from nicks, scratches, and blemishes.
.3 Replace defective or damaged Materials with new.

.4 Packaging Waste Management: remove for reuse and return pallets, crates, padding and packaging Materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.6 SITE CONDITIONS

.1 Do not begin Work of this Section until:
.1 Floor and ceiling finishes are complete.
.2 Substrate and ambient temperature is above 15 deg. C.
.3 Relative humidity is below 80 %.

.2 Install temporary protection and facilities to maintain Product manufacturer's, and above specification, environmental requirements 48 h before, during, and 48 h after installation.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Aluminum extrusions: ASTM B211M and ANSI H35. AA6063 alloy, T5 temper.

.2 Aluminum sheet: ASTM B209 and ANSI H35.1 AA1100 aluminum alloy, H14 temper, minimum 3.0 mm thick.

.3 Galvanized steel sheet: ASTM A653/A653M, Z275; cold rolled, galvanized steel sheet.

.4 Top track: ASTM C645; cold rolled channels, formed from galvanized steel sheet, designed to accept snap-on trim from either side of wall.

.5 Bottom track: ASTM C645; roll formed from galvanized steel sheet, with 38 mm high legs.

.6 Steel studs and runners: ASTM C645; ‘U’ shape, roll formed from galvanized steel sheet, 0.6 mm thick minimum, pre-punched openings for system elements, configured to meet panel system requirements, depth as indicated on Contract Drawings.

.7 Cross locking Channels: ASTM C645; 3350 mm long, roll formed from galvanized steel channels.

.8 Swing door frames: Extruded aluminum, free of exposed fasteners, aluminum door stops with continuous mohair or bulb seals. Frames to be reinforced, mortised, drilled and tapped for door hardware, in size shown on drawings.

.9 Swing doors: 44.5 mm thick solid core door consisting of 448 kg/cu m particle board core with White Ash veneer face and matching edge trim. Provide manufacturer’s standard clear coat finish.

.10 Glass and glazing Materials: to Section 08 80 00.

.11 Glazing frames: Extruded aluminum, complete with snap-on glazing stops and neoprene gaskets for setting glass.

.12 Hardware: In accordance with Division 08 and supplied by demountable partition Supplier.

.13 Trim: Aluminum, to match frames.

.14 Fasteners: ASTM F738M; Stainless Steel Type 304.

.15 Acoustical sealant: type recommended by partition manufacturer to achieve STC rating specified; with VOC limit contents.

2.2 FABRICATION

.1 Fabricate demountable glazed partitions in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Fabricate Work free from defects impairing function, appearance, strength and durability.

.3 Accessories: miscellaneous trim, fasteners, clips, levelling devices, and other accessories required for installation as recommended by partition manufacturer.

2.3 FINISHES

.1 Aluminum:
.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
.1 Clear anodic finish: to AAMA 611 and AA DAF 45 designation AA-A41.
.2 Appearance and properties of anodized finishes designated by Aluminum Association as Architectural Class 1, and Protective and Decorative.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive demountable glazed partitions previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.

3.2 ERECTION

.1 Install demountable glazed partition system in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Install partition system on top of floor finish and accurately fitting to suspended ceiling.

.3 Erect partitions plumb, square, straight, rigid, and with horizontal lines level. Accurately fit and fasten to abutting surfaces.

.4 Provide reinforcement and bracing wherever necessary to assure lateral stability.

.5 Coordinate with mechanical and electrical trades for all services required to be built into partition system.

.6 Fasten runners to floors, ceiling and abutting vertical surfaces at 600 mm o.c. At ceilings, use fasteners that rigidly support partition without damaging or defacing ceiling panels or grid members.

.7 Fasten floor track to substrate at both sides of door frames.

.8 Install continuous light/sound seal at junction between partition system and ceilings, floors, and adjacent abutting surfaces.

.9 Install studs vertically in floor and ceiling track at 600 mm. Install three cross channels per stud.

.10 Install panel clips and hang panels on framework taking care to seat all panel clips on cross channels.

.11 Glaze partition system in accordance with Section 08 80 00.

.12 Install finish hardware in accordance with Section 08 71 11.

.13 Install ceiling trims, base moulding, corners, and other trim to provide a complete system.

.14 The complete installation shall be free of exposed screws or other fasteners, with surfaces free of tool marks, scratches or any other marred surface detrimental to appearance.

3.3 ADJUSTING

.1 Adjust demountable glazed partitions fit accurately in accordance with manufacturer's written recommendations and for smooth and efficient operation.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent Materials caused by demountable glazed partition installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
- .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip. Withdrawn 2014, no replacement.
- .3 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 ASTM B456-17, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.2 CSA International
- .1 CSA B651-18, Accessible Design for the Built Environment.

.3 National Building Code (NBC) 2015.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
- .1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:
- .1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00.
- .2 Deliver special tools to Departmental Representative.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes].
.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse by manufacturer pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating, minimum 30% recycled content.

.2 Stainless steel sheet metal: to ASTM A167, Type 304, with brushed finish, minimum 75% recycled content.

.3 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness, minimum 75% recycled content.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 Toilet tissue dispenser: double roll type, surface mounted, chrome plated steel frame, capacity of double ply roll, roll under spring tension for controlled delivery.

.2 Grab bars: 38 mm diameter x 1.6 mm wall tubing of stainless steel, 76 mm 5diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories, in straight or L-shaped configuration as indicated on drawings. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

.3 Robe hook: chrome plated cast Zamak with 50 mm projection.

.4 Mirror: wall mounted unit, mitred corners welded with polished smooth framed mirror, 6 mm stainless steel frame. Mirror dimensions 610 mm x 910 mm.

.5 Tilt mirror: wall mounted unit, fixed framed mirror, 6 mm stainless steel frame. Mirror dimensions 610 mm x 920 mm.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to ASTM A123/A123M.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Manufacturer's or brand names on face of units not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:
.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
.2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.

.3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
.4 Toilet and shower compartments: use male to female through bolts.

.2 Install grab bars on built-in anchors provided by bar manufacturer to NBC and CSA B651.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

3.6 SCHEDULE

.1 Locate accessories where indicated on drawings and as follows. Exact locations determined by Departmental Representative.

.2 Toilet tissue dispenser: one in each toilet compartment.

.3 Grab bar: two in each handicapped toilet compartment.

.4 Robe hook: Total 22.
.1 Five at B/F Washroom 106.
.2 Five at Washroom 107.
.3 Two at Washroom 204.

.4 Two at each of the following Bedrooms: 108, 109, 112, 113, 114.

.5 Mirror: one prefabricated unit at each wash basin.

.6 Tilt Mirror: one prefabricated unit at each accessible wash basin.

END

PART 1 – GENERAL

1.1 SYSTEM DESCRIPTION

.1 Provide motorized and manual roller shade systems equipped with a decelerator mechanism which permits the unit to go up as smoothly as it comes down. Equip the unit with a rotary clutch enabling exact positioning of the blind at intermediate positions and a stop controller which governs the stop position at the full raised position.

1.2 REFERENCES

.1 Aluminum Association (AA)
.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 American Architectural Manufacturers Association (AAMA)
.1 AAMA 2603-17, Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

.3 National Fire Protection Association (NFPA)
.1 NFPA 701-2019, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit shop drawings indicating opening size, clearances, anchorage, assembly, Materials, components, finishes, and perimeter construction conditions.
.2 Complete electrical wiring diagrams including electrical schematics and sequence of operation.

.4 Samples:
.1 Submit duplicate samples of fabric 900 x 900 mm in accordance with Section 01 33 00. Samples to demonstrate colour and pattern.
.2 Samples to be reviewed and approved by Departmental Representative prior to ordering and installation.

.5 Submit a report by an independent testing laboratory verifying fabric meets flammability and smoke requirements.

1.4 MOCK-UP

.1 Following review of product data sheets install in locations approved by Departmental Representative two operational window roller shades.

.2 Do not install remainder of units until roller shades are accepted by Departmental Representative.

1.5 WARRANTY

.1 For Work of this Section, 12 months warranty period is extended to five years.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 Motorized Roller Blind Units: Extruded aluminum hanger and closure using a linear motor, locking plastic tube and necessary electrical accessories for a single switch or Motor group control operated as indicated. Internal limit switches are adjusted by two hex keys to allow for exact stop positions. Solenoid activated disc brake stops and holds in any position. Asynchronous motor with built in reversible capacitor start and run, 95-125V-AC at 60Hz CSA and UL approved. Complete with fabric type specified.

.2 Aluminum: extruded aluminum to Aluminum Association Alloy 6063-T6, finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes DAF 45, coated finish in accordance with AAMA 2603. Colour to match fabric.

.3 Shading fabric: Vinyl coated polyester, 0.53 mm thick, basket weave design, colour as selected by Departmental Representative from manufacturer's full colour range.

Openness factor	5%
Weight	488 (g/sq.m)
Breaking strength (lbs)	Warp - 315; Fill - 260
Stretch (% at 12.2 kg.wt.)	Warp - 1%; Fill - 7%
Wear	trace
U.V. Deterioration (200 Sun Fade hours)	Fade none
Tensile retention	96%

.4 Blackout fabric: Vinyl coated polyester, 4 ply (1 ply woven fibreglass, 3 ply PVC film, colour as selected by Departmental Representative from manufacturer's full colour range.

Weight (g/sq.m)	12 (oz./sq.yd.)
Tougue tear (lbs)	Warp – 12; Fill - 8
Breaking Strength	- Warp 240; Fill 179
Tear Strength	- Warp 1,360; Fill 720
Tensile Strength	- Warp 246; Fill 207
Flame Test	- NFPA 701 small scale

.5 Accessories: aluminum head rail, fixing clamps, bottom bar, and end caps.

2.2 FABRICATION

.1 Fabricate window roller shade unit, with inside recess top fix end brackets, headrail tube, fabric, bottom weight bar, pull ball set, as a single fully assembled unit capable of being mounted or de-mounted without disassembly.

.2 Headrail tube: 6063-T6 extruded aluminum with internal spring adjustable tension feature capable of holding blind at any intermediate position. Diameter: 75 mm.

.3 Bottom weight bar: extruded aluminum channel, single length for each shade panel complete with weight bar caps, colour to match fabric.

.4 Electrical components:
.1 Internal Limit switches: adjustable with two hex keys to allow exact setting of stop position. Micro switches to provide circuit breaking at end of run. Switch setting not to be disturbed by roller tube action.
.2 Brake: solenoid activated disc brake mechanism stops and holds any position, brake to disengage when motor is running.
.3 Motor: Built-in reversible capacitor start and run. Single phase 95-125V-AC, 60 Hz motor with thermally protected class A temperature rating.
.4 Gear box: Satellite gears with 3 levels for load distribution with planetary type gears machined to close tolerance of tempered steel.
.5 Controls: Motors will be operated by white three position rocker switch, located remotely.

.5 Blackout side and bottom channels: Extruded aluminum channels 38 mm x 28 mm to reduce light infiltration around sides of shade. Channels shall include 11 mm ‘Fuzz’ on both sides to further minimize infiltration.

PART 3 – EXECUTION

3.1 INSTALLATION

.1 Mount shades inside existing window mullions on head, concealed fastening.

.2 Provide shades on every exterior window. Refer to Window Schedule on Drawings for windows to receive motorized or manual roller shades.

.3 Install shades in locations shown using specified fasteners, plumb, true, square, straight, and level in proper planes, complete with all fascias/soffits, trims and accessories.

3.2 ADJUSTMENT AND CLEANING

.1 The shade cloth fabric shall hang flat, without buckling or distortion. The edge, when trimmed, shall hang straight without ravelling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than 3 mm in either direction due to warp distortion, or weave design.

.2 Adjust, correct and lubricate fabric shade as required, to provide smooth and efficient operation without binding.

.3 Clean shade surfaces and remove all finger marks and smudges from fascia, soffits, and trim surfaces. Remove all protective films.

.4 Leave fabric shade in raised position and in first-class condition upon completion of the Work of this Section.

END

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)
.1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.

.2 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
.1 ASHRAE 90.1-2019 (SI Edition), Energy Standard for Buildings Except Low-Rise Residential Buildings.

.3 CSA International (CSA)
.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
.2 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Sheet Steel Building Institute (CSSBI)
.1 CSSBI 30M-17, Standard for Steel Building Systems.

.5 The Master Painters Institute (MPI).
.1 Architectural Painting Specification Manual – 2020 plus amendments.

.6 National Building Code of Canada, NBC 2015.

.7 National Research Council (NRC)/Institute for Research in Construction (IRC)
.1 Construction Technology Update No. 9-1997, Evolution of Wall Design for Controlling Rains Penetration.
.2 Construction Technology Update No. 17-1998, Pressure Equalization in Rainscreen Wall systems.
.3 Construction Technology Update No. 34-1999, Designing Exterior Walls According to the Rainscreen Principle.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:
.1 Convene pre-installation meeting 1 week prior to beginning Work of this Section, with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building construction subtrades.
.4 Review manufacturer's written installation instructions and warranty requirements.
.2 Arrange for site visit with Departmental Representative prior to start of Work to examine existing site conditions adjacent to demolition Work.
.3 Hold project meetings bi-weekly.
.4 Ensure key personnel attend.

.5 Departmental Representative will submit written notification of change to meeting schedule established upon Contract award 24 hours prior to scheduled meeting.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for sealants, insulation, and building Materials and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit 2 copies of WHMIS SDS, for the following.
.1 Sealants.
.2 Tape.
.3 Proprietary joints.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate on drawings related provisions required for mechanical, electrical and other Work.
.3 Submit complete calculated thermal design analysis based on ASHRAE zone method or tests certified by independent analysis signed and sealed by professional engineer registered or licensed in Province of Ontario, Canada.
.4 Submit erection drawings in accordance with CSSBI 30M as follows:
.1 Erection drawings showing foundation loads, anchor bolt setting details, part numbers, connections and assembly details.

.4 Delegated Design Submittals:
.1 Indicate plans and grid lines, structural members and connection details, bearing and anchorage details, roof cladding, wall cladding, framed openings, accessories, schedule of Materials and finishes, camber and loadings, fasteners and welds.
.2 Indicate detailed description of mechanical, electrical and other systems in Work.
.3 Describe requirements of other systems of components related to this Work but provided by others.
.1 Obtain necessary information required to detail this Work including methods of integration and securing.
.4 Submit erection drawings to Departmental Representative for approval, before construction.
.5 Indicate erection dimensions and methods.

.5 Manufacturer's Instructions: submit application instructions for sealant.

.6 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Provide certification from steel building systems manufacturer that erector is qualified to erect system.

.2 Conform to latest MPI requirements for painting Work including preparation and priming.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle Materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store Materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect components and equipment from nicks, scratches, and blemishes.
.3 Replace defective or damaged Materials with new.

1.6 WARRANTY

.1 Contractor warrants Work of this section is in accordance with General Conditions (GC), but for 10 years.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Structural steel: to CSA G20.20/G40.21, hot dipped zinc coated to ASTM A123/A123M to 600 g/m.

.2 Bolts: to ASTM A307 complete with nuts and washers.

.3 Welding Materials: to CSA W59.

.4 Shop primer paint: to MPI #79.

.5 Screws: corrosion resistant purpose made, head colour to match attached sheet.

.6 Composite wall panels: in accordance with Section 07 42 43.

.7 Sheet metal roofing: in accordance with Section 07 61 00.

.8 Metal doors and frames: in accordance with Section 08 11 00.

.9 Aluminum windows: in accordance with Section 08 51 13.

.10 Glass and glazing Materials: in accordance with Section 08 80 00.

.11 Sealants: in accordance with Section 07 92 00.

.12 Vapour barrier and sealing tape: as recommended by steel building systems manufacturer.

.13 Thermal Insulation: in accordance with Section 07 21 29.03.

2.2 SYSTEM DESCRIPTION

.1 Provide building structure and enclosure to physical dimensions as indicated.

.2 Building occupancy as defined by National Building Code of Canada is Group F3, Division B.

.3 Generally, building is intended to enclose uninsulated garage space and insulated workshop.

2.3 DESIGN CRITERIA

.1 Maintain heat transfer to maximum 'U' value of 0.05 as calculated by ASHRAE 90.1 zone method.

.2 Design building to allow for thermal movement of component Materials caused by ambient temperature range of -25 to 35 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.3 Ensure total absence of condensation on interior surfaces under following minimum condition.
.1 Exterior: -25 degrees C, 30 km/h wind.

.4 Building watertight construction.

.5 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with "Rain Screen Principles", as described by NRC/IRC.

.6 Vapour seal building enclosure to withstand, without failure, design RH at design ambient temperature condition, maintained against interior atmospheric pressure of 250 Pa.

.7 Design building enclosure elements to accommodate, by means of expansion joints, movement in wall and structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, water penetration or glass breakage.

.8 Design foundations in accordance with NBC requirements to permissible soil loads listed in soils report or indicated on drawings. Refer to Geotechnical report listed in Appendix A, Search and Rescue Station (SAR) Revitalization. St. Catharines, Ontario – New Garage. Supplementary Geotechnical Investigation. 124-B0017786-0-01-100GE-R0002-01. Prepared by Englobe dated July 29, 2020.

.9 Completed building: exterior to interior sound attenuation not less than STC 30.

.10 Design, assemble and secure building elements to building frame to ensure stresses in sealants and seals are within sealant manufacturer's recommended maximum.

.11 Design building assembly to permit easy replacement of components.
.1 Use non-welded construction.

.12 Allow for ceiling, piping, conduit and other interior dead loads imposed on this structure.

.13 Building utility room environment: insulated areas heated to maintain temperature of 5 degrees C minimum.

.14 Building utility room interior ventilation: of 6 air changes per hour.

.15 Building lighting: maintain measured lighting level of 10 lx at 1500 mm above finished floor, after building finishes and painting complete.

.16 Building glazing: Maximum Solar Heat Gain Coefficient (SHGC) of 0.4 for vision glass, in accordance with OBC requirements (OBC SB-10, Division 03, Chapter 3, Table 3.2.2.3.A).

.17 Access units, doors, and windows to sizes and locations indicated.

2.4 PERFORMANCE CRITERIA

.1 Maximum deflection for roofing under full specified live load: 1/360 of clear span.

.2 Maximum deflection for exterior cladding under full specified exterior wind induced loads: 1/180 of clear span.

.3 Maintain following tolerances for building structure and enclosure elements.
.1 Maximum variation from plane or location shown on shop drawings: 1 mm/1 m of length and up to 1 mm/5 m maximum.
.2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

2.5 FABRICATION

.1 Maintain air, vapour, and thermal barrier throughout building enclosure elements.

.2 Locate vapour barrier on warm side of thermal insulation.

.3 Locate air barrier as detailed.

.4 Complete enclosure assembly with exterior skin, glass units, access units, doors, inner air/vapour seal membrane, thermal insulation and interior

finish.

.5 Accurately fit and rigidly frame together joints, corners and mitres.
.1 Match components carefully to produce continuity of line and design.
.2 Make joints and connections toward exterior weathertight.
.3 Provide hairline joints for Materials in contact.
.4 Co-ordinate location of visible joints.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for prefabricated building erection installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 ERECTION

.1 Do prefabricated metal building Work to CSSBI 30M.

.2 Erect building structure and enclosure elements.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Obtain written report from manufacturer's verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Ensure manufacturer's representative is present before and during critical periods of installation and testing.
.4 Schedule site visits:
.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
.2 Twice during progress of Work at 25% and 60% complete.
.3 Upon completion of Work, after cleaning is carried out.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment in accordance with Section 01 74 00.
.1 Remove excess sealant by moderate use of low VOC mineral spirits or other solvent as directed by sealant manufacturer.
.2 Clean surfaces.

.3 Waste Management: separate waste Materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of Materials at appropriate facility.

3.5 PROTECTION

.1 Protect finished surfaces with strippable coatings, strippable wrappers, plywood or sheet Materials as required before acceptance of Work.

.2 Protect installed products and components from damage during construction.

.3 Repair damage to adjacent Materials caused by sealants, insulation, and building Materials installation.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 09 91 00 – Painting.

.2 Section 23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for all equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:
.1 Drawings to show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances.
.2 Drawings and product data accompanied by:
.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify current model production.
.5 Certification of compliance to applicable codes.
.3 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for all equipment for incorporation into manual.
.1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
.2 Operation data to include:
.1 Control schematics for systems including environmental controls.
.2 Description of systems and their controls.
.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for systems and component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.7 Colour coding chart.
.3 Maintenance data to include:
.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
.2 Data to include schedules of tasks, frequency, tools required

and task time.

.4 Performance data to include:
.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
.2 Equipment performance verification test results.
.3 Special performance data as specified.
.4 Testing, adjusting and balancing reports as specified in Section 23 05 93.

.5 Approvals:
.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
.2 Make changes as required and re-submit as directed by Departmental Representative.

.6 Additional data:
.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:
.1 Departmental Representative will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
.3 Mark up PDF drawings showing work as actually installed. Use a different colour for each service.
.4 Make available for reference purposes and inspection.

.8 As-Built drawings:
.1 Submit in accordance with Section 01 78 00.
.2 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
.3 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
.4 Submit a PDF format to Departmental Representative for approval and make corrections as directed.
.5 As-built drawings shall be all converted to AutoCAD according to PWGSC standards.
.6 Submit as-built AutoCAD and PDF in Flash Drive. Allow for minimum two (2) sets.
.7 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 HVAC&R Equipment:
.1 Refrigerant:
.1 HFC based refrigerant.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 00.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

INFORMATIONAL SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Use operation and maintenance manual, as-built drawings, as-built specifications, and audio visual aids as part of instruction materials.

.3 Instruction duration time requirements as specified in appropriate sections.

.4 Departmental Representative will record these demonstrations on video tape/DVD for future reference.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 This section shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 00.

1.2 REFERENCES

.1 ASTM International
- .1 ASTM A48/A48M-03(2016), Standard Specification for Gray Iron Castings.
- .2 ASTM D2665–20, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- .3 ASTM D2949–18, Standard Specification for 3.25-in. Outside Diameter Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- .4 ASTM B251/B251M–17, Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- .5 ASTM D3034–16, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .6 ASTM F891–16, Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core.
- .7 ASTM D2564-20, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

.2 International Organization for Standardization
- .1 ISO 21940-11:2016, G6.3, Mechanical vibration — Rotor balancing — Part 11: Procedures and tolerances for rotors with rigid behavior.

.3 National Electrical Manufacturers Association (NEMA)
- .1 Design B
- .2 Design L

.4 Ontario Building Code (OBC)

PART 2 - PRODUCTS

2.1 REQUIREMENTS

.1 The septic system shall be built in accordance with Division B Section 8.2 of the Ontario Building Code and R.R.O 1990, Reg. 358: Sewage Systems under the Environmental Protection Act.

.2 Minimum clearance distances shall be in accordance with Division B Section 8.2.1.4 of the Ontario Building Code.

2.2 PUMPING STATION

.1 Pumping station shall be one piece precast concrete construction with an area of 1.5m sq.

.2 It shall be cast with non sulphate resistant 35MPa strength concrete at 28 days with 5-7% air.

.3 Reinforcement:
- .1 Walls: 10M at 300mm O/C walls.

.2 Base and Roof: 10M at 150mm O/C Base and Roof.
.3 Base Mono Base Section: 1.5m x 1.5m x 1.6m.
.4 Riser Section: 1.5m x 1.5m x 1.5m.
.5 Top Section 600mm Polylok Access Point: 1.5m x 1.5m x 0.625m.

.4 It shall have ladder rungs installed and Boot Connectors as per manufacturers specified drawings.

.5 Submersible Grinder Pump

.1 Pumps shall be a centrifugal submersible grinder pump designed to reduce all material found in normal domestic and light industrial sewage including plastics, rubber, sanitary napkins and disposable diapers to finely ground slurry.

.2 Operating Temperature

.1 The liquid being pumped shall be a maximum of 25°C (77°F) continuous, intermittent 60°C (140°F) and shall be capable of running dry for extended periods.

.3 Pump Construction

.1 The volute, seal plates, and motor housing shall be constructed of high quality ASTM A48/A48M class 30 cast iron. The pump shall be painted with a water based air dry enamel of 0.0508mm (2.0 mil) minimum thickness.

.2 All exposed hardware shall be 300 series stainless steel.

.3 Discharge connection shall be a standard 32mm (1 ¼") NPT in the vertical position.

.4 The grinder mechanism shall consist of a radial cutter threaded and locked on the motor shaft by a washer in conjunction with a countersunk flat head cap screw, and a shedding ring containing a minimum of seven flow passages with cutting edges. The shredding ring shall be reversible to provide twice the cutting edge life. Both the shedding ring and the radial cutter shall be constructed of 440c stainless steel hardened to a minimum of Rockwell C-55 and shall be finish ground for fine cutting edge. Two stage cutter mechanism requiring external adjustment for proper clearance are not acceptable.

.5 The pump impeller shall be of the recessed vortex design. Pumps with standard centrifugal semi open impeller designs shall not be acceptable. The impeller shall be of 85-5-5-5 bronze or ASTM A48/A48M class 30 cast iron construction and machined for threading to the motor shaft. The impeller shall be capable of being trimmed to meet the specific performance characteristics.

.6 The unit shall utilize a single mechanical shaft seal which will operate in an oil atmosphere. The materials of construction shall be silicon-carbon for the rotating and stationary faces, lapped and polished to a tolerance of one light band, 300 series hardware and all elastomer parts to be of Buna-N. A secondary Buna N lip seal shall be provided between the mechanical seal and pumped fluid. The seal shall be commercially available and not a proprietary design.

.4 Motor

.1 Single phase motors shall be of the capacitor start, a capacitor run design and the three phase motors shall be of the dual voltage 208/600 V design. The pump shall be designed to be non overloading throughout the entire pump curve.

.2 The rotor and stator assembly shall be of the standard frame design and secured to the pump seal plate by four threaded fasteners allowing for easy serviceability. Motor designs incorporating shrink for press fit assembly between the stator and the motor housing

shall not be acceptable.

.3 The motor shall be constructed with the windings operating in a sealed environment containing clean dielectric oil, making it capable of operating in a totally, partially or non submerged condition for extended periods of time without damage due to the heat being generated. Air filled motors shall not be acceptable.

.4 The motor shall meet the standard NEMA Design L for single phase. The motor shaft shall be of 416 stainless steel. Protection against excessive temperature shall be provided by an overload switch in series with the stator windings. The pump shall have a two bearing design consisting of an upper and lower bearing. Bearings shall operate in an oil bath atmosphere for superior lift. Permanently lubricated bearings shall not be acceptable.

.5 Power Cable

.1 The pump shall be equipped with sufficient SOW power cable to connect to the control panel and shall be connected to the motor via quick disconnect pin terminals. Pin receptacles shall be crimped and molded to the power cord in a PVC plug.

.2 The plug shall be secured with a stainless steel compression plate to prevent water from entering the housing and to provide strina relief at the point of entry.

.3 A stainless steel clamp shall compress the PVC molding against the cable jacket to prevent water from entering the jacket. A polybutylene terephthalate terminal block with brass pin inserts shall connect the power cord leads with the motor leads. The ground pin shall be longer than the other pins such that the ground connection is the first connection made and the last connection broken when the pin is inserted and removed. A Buna N O ring shall provide isolation sealing between the terminal block and the motor housing when the cord plug is removed.

.6 Pump Test

.1 The pump manufacturer shall perform the following inspections and tests in accordance with Hydraulic Institute type B standards prior to shipment from the factory.

.2 A check of the motor voltage and frequency shall be made as shown on the name plate.

.3 A motor and cable insulation test for moisture content or insulation defects shall be made per UL criteria.

.4 The pump shall be completely submerged and run to determine that the unit meets three predetermined hydraulic performance points.

.5 A written report shall be available showing the aforementioned tests have been performed in accordance with the specifications.

.7 Start Up

.1 The pump(s) shall be tested at start up by a qualified representative of the manufacturer.

.2 A start up report shall be provided by the manufacturer and shall be completed prior to final acceptance of the pump(s).

.8 Capacity: Refer to pump schedule.

2.3 ANEROBIC DIGESTOR

.1 Anaerobic digester shall be one piece precast concrete construction. The top shall be sealed with fibrous mastic sealant.

.2 It shall be cast with non sulphate resistant 35MPa strength concrete at 28 days with 5-7% air.

.3 Reinforcement:
.1 walls: 10M bars at 600mm centres vertically and 10M bars at 400mm centres horizontally in walls.
.2 Base and Roof: 10M bars at 300mm centres each way.
.3 4 Extra 15M bars diagonally around access opening.
.4 Minimum 25mm cover over reinforcing steel.

.4 Inner Tube shall be constructed of a flexible, single-wall, poly pipe. The Inner Tube shall configured to be long and narrow to increase settling distance, increase retention time within the InnerTube, and prevent short-circuiting. The outlet of the InnerTube shall be located opposite the outlet of the pump to further increase settling distance and digestion.

.5 Anaerobic digesters shall be sized using the design flow of the building based on a minimum retention time of 1.89 days (1.89 x Q), of which a minimum 0.2 days (0.2 x Q) retention is inside the InnerTube pipe. (Q = Flowrate L/day)

.6 Anaerobic Tank Pump:
.1 Pump shall be capable of handling raw unscreened sewage consisting of water, fibrous 20mm (3/4") diameter spherical solids.
.2 Operating Temperature:
The pump shall be capable of handling liquids with temperatures of 49°C (120°F) continuous and shall be capable of running dry for extended periods.
.3 Pump Construction:
.1 The volute, seal plates, and motor housing shall be constructed of high quality ASTM A48/48M class 30 cast iron. The pump shall be painted with a water based air dry enamel of 0.0508mm (2.0 mil) minimum thickness.
.2 All exposed hardware shall be 300 series stainless steel. The pump construction shall contain no points of critical clearance nor require periodic adjustment or replacement to maintain operating efficiency.
.3 Discharge connection shall be a standard 50mm (2") NPT in the vertical position. All caskets shall be of the compression square ring type to eliminate critical slip fits and the possibility of damage during service associated with sliding O-ring sealing arrangements.
.4 The pump impeller shall be of a non clog design with pump out vanes on the back side. The impeller shall be dynamically balanced to ISO 21940-11 G6.3 specifications.
.5 The unit shall utilize a single mechanical shaft seal which will operate in an oil atmosphere. The materials of construction shall be carbon for the rotating face and ceramic for the stationary face, lapped and polished to a tolerance of one light band, 300 series hardware and all elastomer parts to be of Buna-N. The seal shall be commercially available and not a proprietary design.
.4 Motor:
.1 The pump shall be designed to be non-overloading throughout the entire pump curve.
.2 The rotor and stator assembly shall be of the standard frame design and secured to the pump seal plate by four threaded fasteners allowing for easy serviceability. Motor designs incorporating shrink for press fit assembly between the stator and the motor housing shall not be acceptable.
.3 The motor shall be constructed with the windings operating in a sealed environment containing clean dielectric oil, making it

capable of operating in a totally, partially or non submerged condition for extended periods of time without damage due to the heat being generated. Air filled motors shall not be acceptable.

.4 The motor shall meet the standard NEMA Design L for single phase and NEMA design B for three phase. The motor shaft shall be of 416 stainless steel. The lower bearing shall be of the single ball type to accept radial loads and the upper bearing of the sleeve or ball design, for radial loads. Bearings shall operate in an oil bath atmosphere for superior lift. Permanently lubricated bearings shall not be acceptable.

.5 Thermal sensor shall be provided for use on three phase units to monitor the stator temperatures. The stator shall be equipped with a thermal switch embedded in the end coil of the stator winding. This shall be used in conjunction with external motor overload protection and wired to the control panel. Single phase shall have an overload switch on the motor windings and do not required any external protection.

.5 Power Cable

.1 The pump shall be equipped with sufficient power cable to connect to the control panel.

.2 Power cable shall be connected to the motor via quick disconnect spade terminals. Crimp connected cords are not acceptable. A secondary rubber pressure grommet shall be provided as an additional sealing point and strain relief at the point of cable entry. Cable entry designs utilizing terminal boards to connect power cord leads with motor leads are not acceptable.

.6 Pump Test

.1 The pump manufacturer shall perform the following inspections and tests in accordance with Hydraulic Institute type B standards prior to shipment from the factory.

.2 A check of the motor voltage and frequency shall be made as shown on the name plate.

.3 A motor and cable insulation test for moisture content or insulation defects shall be made per UL criteria.

.4 The pump shall be completely submerged and run to determine that the unit meets three predetermined hydraulic performance points.

.5 A written report shall be available showing the aforementioned tests have been performed in accordance with the specifications.

.7 Start Up

.1 The pump(s) shall be tested at start up by a qualified representative of the manufacturer.

.2 A start up report shall be provided by the manufacturer and shall be completed prior to final acceptance of the pump(s).

.8 Capacity: Refer to pump schedule.

2.4 BIOFILTER DOSING PUMP TANK

.1 Biofilter dosing tank shall be one piece precast concrete construction. The top shall be sealed with fibrous mastic sealant.

.2 It shall be cast with non sulphate resistant 35MPa strength concrete at 28 days with 5-7% air.

.3 Reinforcement:

.1 Walls: 10M bars at 600mm centres vertically and 10M bars at 400mm centres horizontally in walls.

.2 Base and Roof: 10M bars at 350mm centres each way
.3 Minimum 25mm cover over reinforcing steel.

.4 The system shall work on timed frequency-duration basis.

.5 Doses shall be sized to deliver between 6 – 10 L per m3 of foam in the treatment unit (approximately 1% of the design flow per dose).

.6 Control panel timer shall be set as per manufacturer's recommendation.

.7 Biofilter dosing pump tanks for systems with internal pump chambers designed for > 3000 L/day, shall be sized using the design flow of the building based on a minimum pumping capacity of 0.5 days (0.5 x Q), as well as a minimum reserve capacity of 0.2 days (0.2 x Q). Systems designed for < 3000 L/day using an external pump tank are sized using the design flow of the dwelling based on a minimum pumping capacity of 0.3 days (0.3 x Q), as well as a minimum reserve capacity of 0.2 days (0.2 x Q). (Q = Flowrate L/day).

.8 Biofilter Dosing Pump:
.1 Pump shall be capable of handling raw unscreened sewage consisting of water, fibrous 20mm (3/4") diameter spherical solids.
.2 Operating Temperature
.1 The pump shall be capable of handling liquids with temperatures of 49°C (120°F) continuous and shall be capable of running dry for extended periods.
.3 Pump Construction
.1 All exposed hardware shall be 300 series stainless steel. The pump construction shall contain no points of critical clearance nor require periodic adjustment or replacement to maintain operating efficiency.
.2 Discharge connection shall be a standard 50mm (2") NPT in the vertical position. All caskets shall be of the compression square ring type to eliminate critical slip fits and the possibility of damage during service associated with sliding O-ring sealing arrangements.
.3 The pump impeller shall be of a non clog design with pump out vanes on the back side. The impeller shall be dynamically balanced to ISO 21940-11 G6.3 specifications.
.4 The unit shall utilize a single mechanical shaft seal which will operate in an oil atmosphere. The materials of construction shall be carbon for the rotating face and ceramic for the stationary face, lapped and polished to a tolerance of one light band, 300 series hardware and all elastomer parts to be of Buna-N. The seal shall be commercially available and not a proprietary design.
.4 Motor
.1 The pump shall be designed to be non overloading throughout the entire pump curve.
.2 The rotor and stator assembly shall be of the standard frame design and secured to the pump seal plate by four threaded fasteners allowing for easy serviceability. Motor designs incorporating shrink for press fit assembly between the stator and the motor housing shall not be acceptable.
.3 The motor shall be constructed with the windings operating in a sealed environment containing clean dielectric oil, making it capable of operating in a totally, partially or non submerged condition for extended periods of time without damage due to the heat being generated. Air filled motors shall not be acceptable.
.4 The motor shall meet the standard NEMA Design L for single phase

and NEMA design B for three phase. The motor shaft shall be of 416 stainless steel. The lower bearing shall be of the single ball type to accept radial loads and the upper bearing of the sleeve or ball design, for radial loads. Bearings shall operate in an oil bath atmosphere for superior lift. Permanently lubricated bearings shall not be acceptable.

.5 Thermal sensor shall be provided for use on three phase units to monitor the stator temperatures. The stator shall be equipped with a thermal switch embedded in the end coil of the stator winding. This shall be used in conjunction with external motor overload protection and wired to the control panel. Single phase shall have an overload switch on the motor windings and do not required any external protection.

.5 Power Cable

.1 The pump shall be equipped with sufficient power cable to connect to the control panel.

.2 Power cable shall be connected to the motor via quick disconnect spade terminals. Crimp connected cords are not acceptable. A secondary rubber pressure grommet shall be provided as an additional sealing point and strain relief at the point of cable entry. Cable entry designs utilizing terminal boards to connect power cord leads with motor leads are not acceptable.

.6 Pump Test

.1 The pump manufacturer shall perform the following inspections and tests in accordance with Hydraulic Institute type B standards prior to shipment from the factory.

.2 A check of the motor voltage and frequency shall be made as shown on the name plate.

.3 A motor and cable insulation test for moisture content or insulation defects shall be made per UL criteria.

.4 The pump shall be completely submerged and run to determine that the unit meets three predetermined hydraulic performance points.

.5 A written report shall be available showing the aforementioned tests have been performed in accordance with the specifications.

.7 Start Up

.1 The pump(s) shall be tested at start up by a qualified representative of the manufacturer.

.2 A start up report shall be provided by the manufacturer and shall be completed prior to final acceptance of the pump(s).

.8 Capacity: Refer to pump schedule.

2.5 TYPE A DISPERSAL BEDS

.1 The dispersal bed shall be built in accordance with Division B Section 8.7.7 “Type A Dispersal Beds” of the Ontario Building Code.

.2 The treatment unit used in conjunction with a leaching bed constructed as a Type A dispersal bed shall provide an effluent quality that does not exceed the maximum concentrations set out for a Level IV treatment unit i.e. the maximum concentration of suspended solids and CBOD be 10mg/L each based on a 30 day average.

.3 A Type A dispersal bed shall be backfilled with leaching bed fill so as to ensure that, after the leaching bed fill settles, the surface of the leaching bed will not form any depressions.

.4 The combined thickness of the sand layer and the stone layer, if utilized,

of a Type A dispersal bed shall not be less than 500mm.

.5 The sand layer shall,
.1 be comprised of sand that has,
.1 a percolation time of at least 6 and not more than 10 min, and
.2 not more than 5% fines passing through a 0.074mm (No. 200) sieve,
.2 have a minimum thickness of 300mm, and
.3 have an area that is not less than the lesser of,
.1 the area of the stone layer determined in accordance with Sentence (7) or, if leaching chambers are used, the area over which the leaching chambers are spaced determined in accordance with Sentence (7.1), and
.2 the value determined by the formula, A = QT/850

where,
A = the area of contact in square meters between the base of the sand and the underlying soil,
Q = the total daily design sanitary sewage flow in liters, and
T = the lesser of 50 and the percolation time of the underlying soil.

.6 Where the underlying soil has a percolation time of more than 15 min, the sand layer referred to in Sentence (5) shall,
.1 extend to at least 15 m beyond the perimeter of the treatment unit, or the centerlines of the outer distribution pipes or leaching chambers if utilized, in any direction in which the effluent entering the soil or leaching bed fill will move horizontally, and
.2 have an area that is not less than the value determined by the formula, A=QT/400

where,
A = the area of contact in square metres between the base of the sand and the underlying soil, or leaching bed fill if utilized,
Q = the total daily design sanitary sewage flow in litres, and
T = the lesser of 50 and the percolation time of the underlying soil.

.7 .1 Where a stone layer is used, the stone layer shall,
.1 be rectangular in shape with the long dimension parallel to the site contours,
.2 have a minimum thickness of 200mm,
.3 be protected in the manner described in accordance with Division B Section 8.7.3.3.(2) of the Ontario Building Code.
.4 be constructed such that the bottom of the stone layer is at least 600mm above the high ground water table, rock or soil with a percolation time of 1 min or less or greater than 50 min.
.5 have a minimum area not less than the value determined by the formula, A = Q/B

where,
A = the area of the stone layer in square metres,
B = the following amount,
(i) 50, if the total daily design sanitary sewage flow exceeds 3000 litres, or
(ii) 75, if the total daily design sanitary sewage flow does not exceed 3000 litres, and

Q = the total daily design sanitary sewage flow in litres.

.2 Where leaching chambers are used,
.1 the Type A dispersal bed shall be rectangular in shape with the long dimension parallel to the site contours, and
.2 the leaching chambers shall,
.1 be evenly spaced over the area calculated in Subclause (4), with a maximum distance of 200mm between the exterior edges of the lines of leaching chamber,
.2 be protected in the manner described in Division B Clause 8.7.3.4.(1)(f) of the Ontario Building Code,
.3 be constructed such that the bottom of the leaching chambers is at least 600mm above the high ground water table, rock or soil with a percolation time of 1 min or less or greater than 50 min, and
.4 have a minimum area not less than the value determined by the formula, A = Q/B

where,
A = the area over which the leaching chambers are spaced, in square metres,
B = the following amount,
(i) 50, if the total daily design sanitary sewage flow exceeds 3000 litres, or
(ii)75, if the total daily design sanitary sewage flow does not exceed 3000 litres, and
Q = the total daily design sanitary sewage flow in litres.

.8 Leaching bed fill with a percolation time not exceeding 15 min may be used to satisfy the vertical separation requirements of Clause (7)(4) or Subclause (7.1)(2)(3), provided that the leaching bed fill conforms to the requirements specified in Sentence(6) regardless of the percolation time of the underlying soil.

.9 In addition to other requirements, leaching bed fill must comply with environmental quality requirements in Subsection 1.10 of Section 01 35 13.43.

.10 Stone layer / Leaching chamber:
.1 Where a stone layer is used, the effluent shall be evenly distributed within the stone layer to within 600mm of the perimeter of the stone layer.
.2 Where leaching chambers are used, the effluent shall be evenly distributed within the area over which the leaching chambers are spaced to within 600mm of the perimeter of that area.

.11 The stone layer or area over which the leaching chambers are spaced shall not be located closer than the minimum horizontal distances set out in following table and these distances shall be increased by twice the height that the leaching bed is raised above the original grade.

Item	Column 1 Object	Column 2 Minimum Clearance, m
1.	Structure	5
2.	Well with a watertight casing to a depth of at least 6 m	15
3.	Any other well	30
4.	Lake	15
5.	Pond	15
6.	Reservoir	15
7.	River	15
8.	Spring not used as a source of potable water	15
9.	Stream	15

2.6 SANITARY PIPING

.1 Piping And Fittings
.1 For buried sanitary piping:
.1 ASTM D2665, ASTM D2949, ASTM B251.
.2 ASTM D3034, ASTM F891.

.2 Joints
.1 Solvent weld for PVC: to ASTM D2564.

.3 Sizes above 100mm (4”)
.1 Provide Ring-Tite joints Canron Ring-Tite joints PVC DR35 gravity sewer pipe, with locked in rubber ring sealing feature providing tight flexible seal.
.2 Spigot ends to be supplied complete with bevel.
.3 All PVC piping below grade shall be a minimum of SDR 35.

2.7 EXCAVATION AND BACKFILL

.1 Grade the bottom of the pipe trench excavation as required.

.2 In firm, undisturbed soil, lay pipes directly on the soil, and shape soil to fit the lower one-third segment of all pipes and pipe bells. Ensure even bearing along the barrels. Backfill excess excavation with 25 MPa (3625 psi) concrete.

.3 Where rock or shale is encountered, arrange to have this excavated and removed by the departmental representative but at this Division’s expense. After excavation, backfill with a bedding of 10mm (3/8") crushed stone. In addition to other requirements, backfill must comply with environmental quality requirements in Subsection 1.10 of Section 01 35 13.43.

.4 Prepare new bedding under the pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls of buildings, at maintenance holes and catch basins. Compact to maximum possible density and support the pipe by 200mm (8") thick firm supports. Install reinforcing steel in cradle or construct piers every eight feet or closer, down to solid load bearing strata. Provide a minimum of one pier per length of pipe. Use same method where pipes cross.

.5 Where excavation is necessary in proximity to and below the level of any footing, backfill with 25 MPa (3625 psi)concrete to the level of the highest

adjacent footing. Proximity is determined by the angle of repose as established by the departmental representative.

.6 Provide support over at least the bottom one third segment of the pipe in all bedding methods.

.7 Do not open trench ahead of pipe laying and backfilling more than weather will permit. Keep walls of trenches straight to at least 450mm (18")above the top of the pipe to keep the diameter load within the pipe design limits. Have excavations inspected at least once a week by authorities.

.8 Before backfilling, obtain approval. Remove all shoring during backfill.

.9 Backfill trenches outside buildings, not under roads, parking lots, or traffic areas, up to a compacted level of 450mm (18") above the pipes with individual layers of material 150mm (6")thick, hand compacted to a density of 95% Standard Proctor, using approved 10mm (3/8") crushed stone. Backfill the balance with 150mm (6") layers of approved imported clean backfill material in accordance with Subsection 1.10 of Section 01 35 13.43, compacted to 95% Standard Proctor, using approved equipment.

.10 Backfill all other trenches outside buildings with 150mm (6") 10mm (3/8") crushed stone in layers not exceeding 150mm (6")thickness, compacted to 100% Standard Proctor density up to grade level. Manual compaction up to 450mm (18")above the pipe with approved equipment for the balance.

.11 Fill all depressions to a correct grade level with appropriate material. After a period has passed adequate to reveal any settlement, use maximum possible compaction. Pay all costs required to make good all damages caused by settlement.

.12 All excavated materials shall be removed from site in accordance with Subsection 1.9 of Section 01 35 13.43.

PART 3 - EXECUTION

3.1 The septic system shall be installed in accordance with the requirements outlined in Division B Part 8 “Sewage Systems” of the Ontario Building Code.

3.2 All tanks shall be installed in accordance with the manufacturer’s recommendations.

3.3 Discharge from the septic pump tank chamber shall be 50mm and shall return to 100mm in diameter to gravity flow into the septic bed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Materials and installation for plumbing pumps.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015)
.1 Safety Data Sheets (SDS).

.2 ASTM International
.1 ASTM A536-84(2019)e1 – Standard Specification for Ductile Iron Castings.
.2 ASTM A48/48M-03(2016) - Standard Specification for Gray Iron Castings.

.3 American National Standards Institute (ANSI)/NSF International
.1 NSF/ANSI/CAN 61-2020 – Drinking Water System Components - Health Effects.
.2 NSF/ANSI/CAN 600-2019 - Health Effects Evaluation and Criteria for Chemicals in Drinking Water.

.4 International Organization for Standardization
.1 ISO 21940-11:2016 Mechanical vibration — Rotor balancing — Part 11: Procedures and tolerances for rotors with rigid behavior.

.5 Underwriter’s Laboratories (UL)
.1 UL 508 (2018) - Standard for Industrial Control Equipment

.6 Occupational Safety and Health Administration (OSHA)
.1 OSHA 29 - Code of Federal Regulations (CFR)

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
.2 Submit WHMIS SDS – Safety Data Sheets. Indicate VOC's for adhesive and solvents during application and curing.

.3 Shop Drawings.
.1 Submit shop drawings to indicate:
.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
.2 Wiring and schematic diagrams.
.3 Dimensions and recommended installation.
.4 Pump performance and efficiency curves.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00, include:
.1 Manufacturers name, type, model year, capacity and serial number.
.2 Details of operation, servicing and maintenance.
.3 Recommended spare parts list with names and addresses.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
.3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
.4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
.5 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER BOOSTER SYSTEM

.1 Refer to Mechanical Schedules in drawing M002.

2.2 CAPACITY

.1 Capacity for all pumps shall be as indicated on the schedule.

2.3 SUMP PUMPS

.1 Pump Mounting Arrangement
.1 Hydraulic sealing flange: A hydraulically operated sealing flange, complete with Buna N rubber diaphragm type sealing gasket, shall be mounted on each pump discharge. The diaphragm shall be held in place by a 300 series stainless steel ring with stainless steel fasteners.
.2 When the pump is activated, the resulting discharge pressure shall force the diaphragm seal against the flange face of the discharge elbow providing a leak proof seal. When pressure is removed, the diaphragm shall relax so that there is no mechanical connection to the discharge, and pump with hydraulic sealing flange may be easily removed. Units utilizing metal to metal connection which could corrode together shall not be acceptable.

.3 Guide Rail: The guide rails used to direct the pump in proper alignment with the stationary discharge piping shall be of a dual ail design. The rail shall be a 50mm (2") corrosion resistant pipe and positioned on the centerline of the pump to each side so that no weight of the pump bears on either of the two guide rails at any time. The guide rails shall serve truly as a guide rail. Units which do not have the guide rails positioned on the centerline of the pump with off centered weight distribution shall not be considered.

.4 Carrier Guide Bracket: A sliding guide bracket shall be attached to the pump. The sliding carrier guide bracket shall be fabricated from steel and protected with a corrosion resistant coating. The carrier shall be mounted on the pump so lifting is done from the carrier and no strain is placed on the pump or guide rails. Fasteners shall be 300 Series stainless steel. The carrier shall be designed to lift from a centered loop.

.5 Discharge Base Elbow With Base Plate: A discharge elbow shall be furnished for each pump. The discharge base elbow shall be attached to a flat steel fabricated base plate which rests squarely on the wet well floor. The flat base plate shall assure the pump has a smooth surface on which to rest when lowered into position. The base plate shall include a leveling bolt adjustment as well as adjustable guide rail supports which hold the guide rail pipes at the bottom. The pump discharge with hydraulic sealing flange shall align with the base elbow of the base plate assembly. The sealing face of the base discharge elbow shall be smooth and shall be heavily coated with zing to provide a smooth corrosion resistant and abrasion resistant surface. All fasteners shall be 300 series stainless steel.

.6 When the pump is lowered into place, it shall rest squarely on the base plate, supported only by the feet on the pump. Units which hang from the discharge elbow shall not be acceptable as undue stress may occur on the volute case casing of the pump or on the base elbow of the base plate assembly.

.7 Lift Chain: Each pumps shall be provided with a galvanized lifting chain or cable. The lifting chain or cable shall be of sufficient length to extend from the pumping unit at one end to the top of the wet well at the other end. The access frame shall provide a hook to attach the lifting chain or cable when not in use. The lifting chain or cable shall be sized according to the pumps weight. Provide appropriate chain hooks to permit lifting of pump from well for inspection and service.

.2 Piping

.1 Piping: Piping shall include one swing check valve with outside lever and spring, and one plug valve. Piping shall include all necessary elbows and tees.

.2 All piping shall be coated with coal tar epoxy or equal for corrosion resistance. Where piping passes through the wall the pipes shall be sealed to make a water tight joint.

.3 Refer to Section 22 13 17 for material and connections.

.3 Controls

.1 Controls: Provide packaged duplex control system. Duplex controls shall be housed in CEMA I sheet metal enclosure and shall comprise of the following:

.1 Main disconnect switch.

.2 Fuse Clips

.3 Full voltage magnetic starters complete with overload

protection for each phase.
.4 110 Volt control circuit transformer.
.5 Selector switch for each pump (Hand/Off/Auto).
.6 Green pump “running” light for each pump.
.7 Red pump “fault” light. Pump fault shall be provided with a dry contact for connection to the EMCS. The pump status shall be provided by current switches provided across the starter for each motor. If the control panel calls for the pump to be running and the current switch indicates no flow an alarm shall be generated and through a dry contact an alarm shall be sent to the EMCS.
.8 High water alarm complete with audio, visual, indication and silence switch. High water alarm shall be provided with dry contact for connection to EMCS.
.9 Terminal strip for mercury type level control (Off, Primary pump on, Sec. Pump on, High level)
.10 Mercury type level controls with waterproof cables.
.11 Automatic lead, lag alternator, electric.

.2 Allow for connection of high water alarm to Building Automation System.

.3 Pumps shall be controlled as follows:
.1 On sump level rise lower switch shall first be energized, then upper level switch shall next energize and start lead pump.
.2 With lead pump operating, sump level shall lower to low switch turn off setting and pump shall stop. Alternating relay shall index on stopping of pump so that lag pump will start first on next operation and become lead pump.
.3 If sump level continues to rise when lead pump is operating, override switch shall energize and start lag pump.
.4 Both lead and lag pump shall operating together until low level switch turns off both pumps. If level continues to rise when both pumps are operating, alarm switch shall energize and signal the alarm.

.4 Alarm signal shall close a contact to alarm at BAS. All level switches shall be adjusted for level setting from the surface.

.5 The power connection for the high level alarm must be independent of the power feed to the pump control panel.

.4 Non Clog Sump Pump - Submersible Duplex

.1 Pump shall be capable of handling raw unscreened sewage consisting of water, fibrous 50mm (2”) diameter spherical solids.

.2 Operating Temperature
.1 The pump shall be capable of handling liquids with temperatures of 40ºC (104ºF) continuous, 71.1ºC (160ºF) intermittent and shall be capable of running dry for extended periods.
.2 Where indicated on the schedule as “high temperature operation” the pump shall be capable of handling liquids with temperatures of 93.3ºC (200ºF) continuous and shall be capable of running dry for extended periods.

.3 Pump Construction
.1 The volute, seal plates, and motor housing shall be constructed of high quality ASTM A48/48M class 30 cast iron. The pump shall be painted with a water based air dry enamel of 0.0508mm (2.0 mil) minimum thickness.
.2 All exposed hardware shall be 300 series stainless steel. The pump construction shall contain no points of critical clearance nor

require periodic adjustment or replacement to maintain operating efficiency.

.3 Discharge connection shall be a standard 50mm (2″) NPT in the vertical position. All caskets shall be of the compression square ring type to eliminate critical slip fits and the possibility of damage during service associated with sliding O-ring sealing arrangements.

.4 The pump impeller shall be of a non-clog design with pump out vanes on the back side. The impeller shall be dynamically balanced to ISO 21940-11 G6.3 specifications.

.5 The unit shall utilize a single mechanical shaft seal which will operate in an oil atmosphere. The materials of construction shall be carbon for the rotating face and ceramic for the stationary face, lapped and polished to a tolerance of one light band, 300 series hardware and all elastomer parts to be of Buna-N. The seal shall be commercially available and not a proprietary design.

.4 Motor

.1 The pump shall be designed to be non-overloading throughout the entire pump curve.

.2 The rotor and stator assembly shall be of the standard frame design and secured to the pump seal plate by four threaded fasteners allowing for easy serviceability. Motor designs incorporating shrink for press fit assembly between the stator and the motor housing shall not be acceptable.

.3 The motor shall be constructed with the windings operating in a sealed environment containing clean dielectric oil, making it capable of operating in a totally, partially or non-submerged condition for extended periods of time without damage due to the heat being generated. Air filled motors shall not be acceptable.

.4 The motor shall meet the standard NEMA Design L for single phase and NEMA design B for three phase. The motor shaft shall be of 416 stainless steel. The lower bearing shall be of the single ball type to accept radial loads and the upper bearing of the sleeve or ball design, for radial loads. Bearings shall operate in an oil bath atmosphere for superior lift. Permanently lubricated bearings shall not be acceptable.

.5 Thermal sensor shall be provided for use on three phase units to monitor the stator temperatures. The stator shall be equipped with a thermal switch embedded in the end coil of the stator winding. This shall be used in conjunction with external motor overload protection and wired to the control panel. Single phase shall have an overload switch on the motor windings and do not required any external protection.

.5 Power Cable

.1 The pump shall be equipped with sufficient power cable to connect to the control panel.

.2 Power cable shall be connected to the motor via quick disconnect spade terminals. Crimp connected cords are not acceptable. A secondary rubber pressure grommet shall be provided as an additional sealing point and strain relief at the point of cable entry. Cable entry designs utilizing terminal boards to connect power cord leads with motor leads are not acceptable.

.6 Pump Test

.1 The pump manufacturer shall perform the following inspections and tests in accordance with Hydraulic Institute type B standards

prior to shipment from the factory.
.2 A check of the motor voltage and frequency shall be made as shown on the name plate.
.3 A motor and cable insulation test for moisture content or insulation defects shall be made per UL criteria.
.4 The pump shall be completely submerged and run to determine that the unit meets three predetermined hydraulic performance points.
.5 A written report shall be available showing the aforementioned tests have been performed in accordance with the specifications.

.7 Start Up
.1 The pump(s) shall be tested at start up by a qualified representative of the manufacturer.

2.4 PRESSURE BOOSTER PUMPS

.1 Provide a pre-fabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.

.2 Capacity: Refer to pump schedule.

.3 Lead and the duty pumps shall be alternated automatically.

.4 The pumps shall be selected so that the pump motor combination assures maximum utilization of motor horsepower.

.5 Pump Package to Include
.1 Pump efficiencies to match the selected HP. Alternates that use more energy and require more HP for the same flow/head will NOT be considered.
.2 Ethernet connection or serial communications card capability for future use
.3 Hand on/off switches.
.4 2 year manufacturer’s warranty.

.6 Pumps
.1 Pumps shall be NSF/ANSI/CAN 61/NSF/ANSI/CAN 600 approved for drinking water.
.2 Pumps shall be vertical inline multi stage design.
.3 The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
.4 The pump impellers shall be secured directly to the smooth pump shaft by means of a split cone and nut design.
.5 The suction/discharge base shall have ANSI Class 300 flange connections in a slip ring (rotating flange) design as indicated in the drawings or pump schedule.
.6 Pump Construction.

.1	Suction/discharge base, pumphead:	Ductile Iron (ASTM A536 Grade 65-45-12)
.2	Shaft couplings, flange rings:	Ductile Iron (ASTM A536 Grade 65-45-12)
.3	Shaft:	431 Stainless Steel
.4	Motor Spool:	Cast Iron

(ASTM A48/48M Class 30)

.5 Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel.

.6 Impeller wear rings: 304 Stainless Steel.

.7 Intermediate Bearing Journals: Tungsten Carbide.

.8 Intermediate Chamber Bearings: Leadless Tin Bronze.

.9 Chamber Bushings: Graphite Filled PTFE.

.10 O-rings: EPDM.

.11 The shaft seal shall be a single balanced metal bellows cartridge with the following construction:

.1 Bellows: 904L Stainless Steel.

.2 Shaft Sleeve, Gland Plate, Drive Collar: 316 - Stainless Steel.

.3 Stationary Ring: Carbon.

.4 Rotating Ring: Tungsten Carbide.

.5 O-rings: EPDM.

.7 Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, motor couplings, motor and seal cover. The entire cartridge shaft seal shall be removable as a one piece component. Pumps with motors equal to or larger than 15 hp shall have adequate space within the motor spool so that shaft seal replacement is possible without motor removal.

.8 Suction and discharge connections shall be provided with drilled and tapped pressure gauge connections. Provide a shaft sleeve, extending the full length of the mechanical seal area.

.9 Pump System Controller

.1 The pump system controller shall be a standard product developed and supported by the pump manufacturer.

.2 Controllers shall be housed in a NEMA Type1 enclosure with touch screen operator interface and one main disconnect. Control panel shall be equipped with virtual Hand-Off-Auto control switches on display panel for user control of pump motors, and variable frequency drives. Control panel is to be complete with 3 leg overload and short circuit protection, 120V control circuit transformer and integral, fused 24V controller power supply.

.3 The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller user interface shall have a VGA display with a minimum screen size of 87mm x 112mm for easy viewing of system status parameters and for field programming. The display shall have a back light with contrast adjustment. Password protection of system settings shall be standard.

.4 The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections.

.5 The controller shall display the following as status readings from a single display on the controller (this display shall be the default):

.1 Current value of the control parameter, (typically discharge pressure).

.2 Most recent existing alarm (if any).

.3 System status with current operating mode.

.4 Status of each pump with current operating mode and rotational speed as a percentage (%).

.6 The controller shall have as a minimum the following hardware

inputs and outputs:

.1 Three analog inputs (4-20mA or 0-10VDC).
.2 Three digital inputs.
.3 Two digital outputs.
.4 Ethernet connection.
.5 Field Service connection to PC for advanced programming and data logging.
.6 Pump system programming (field adjustable) shall include as a minimum the following:
.7 Water shortage protection (analog or digital)
.8 Transducer Settings (Suction and Discharge Analog supply/range)
.9 PI Controller (Proportional gain and Integral time) settings
.10 High system pressure indication and shut-down
.11 Low system pressure indication and shut-down
.12 Low suction pressure/level shutdown (via digital contact).
.13 Low suction pressure/level warning (via analog signal).
.14 Low suction pressure/level shutdown (via analog signal).
.15 Flow meter settings (if used, analog signal.)

.7 With additional input/output modules, the system controller shall be able to accept up to seven closed loop programmable set-points and seven open loop programmable set-points.

.8 The controller shall have advanced water shortage protection. When analog sensors (pressure) are used for water shortage protection, there shall be two indication levels. One level is for warning indication only (indication that the water pressure is getting lower than expected levels) and the other level is for complete system shut-down (water pressure is so low that pump damage can occur). System restart after shut-down shall be manual or automatic (user selectable).

.9 The system pressure set-point shall be capable of being automatically adjusted by using an external set-point influence. The set-point influence function enables the user to adjust the control parameter (typically pressure) by measuring an additional parameter. (Example: Lower the system pressure set-point based on a flow measurement to compensate for lower friction losses at lower flow rates).

.10 The controller shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) for system pressure as well as a remote system on/off (digital) signal.

.11 The pump system controller shall store up to 24 warning and alarms in memory. The time, date and duration of each alarm shall be recorded. A potential-free relay shall be provided for alarm notification to the building management system. The controller shall display the following alarm conditions:

.1 High System Pressure.
.2 Low system pressure.
.3 Low suction pressure (warning and/or alarm).
.4 Individual pump failure.
.5 VFD trip/failure.
.6 Loss of sensor signal (4-20 mA).
.7 Loss of remote set-point signal (4-20mA).

.8 System power loss.
.9 Controller failure.
.10 Suction or discharge pressure transmitter failure.

.12 The pump system controller shall be mounted in a NEMA 4 enclosure (NEMA 3R if cooling fan is required). The entire control panel shall be UL 508 listed as an assembly. The control panel shall include a main disconnect, variable frequency drives for each pump and the control circuit and control relays for alarm functions.

.13 Control panel shall include, but not be limited to:

.1 Pump Run Lights.
.2 Pump Alarm Lights.
.3 System Fault Light.
.4 Audible Alarm (80 dbA).
.5 Surge Arrestor.
.6 Control Panel Internal Illumination.
.7 Emergency/Normal Operation Switches.
.8 Service Disconnect Switches.

.14 The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor (typically discharge pressure).

.15 The controller shall have a pump "Test Run" feature such that pumps are switched on during periods of inactivity (system is switched to the "off" position but with electricity supply still connected). The inoperative pumps shall be switched on for a period of two to three (2-3) seconds every 24 hours, 48 hours or once per week (user selectable).

.16 The controller shall be capable of providing instantaneous power consumption (Watts or kilowatts) and cumulative energy consumption (kilowatt-hours) when connected to integrated VFD motors through the field bus.

.17 The actual pump performance curves (5th order polynomial) shall be loaded (software) into the pump system controller.

.18 All controls to be factory pre-wired and tested in accordance with provisions of the national electrical code. All control wires shall be individually numbered and each component shall be labeled accordingly. All internal wiring shall be Copper stranded, A.W.G. with a minimum 32.2ºC (90°F) rating. The controller shall bear the UL 508 label for industrial controls.

.10 Pump Sequencing

.1 The pump designated as the lead pump shall run.

.2 The pump controller shall compare a signal from the discharge pressure transducer to the desired set point value. The lead pump speed will ramp up in order to satisfy the set point pressure.

.3 The discharge pressure transducer shall be mounted in the domestic cold water supply line at the top of the building. The Division 22 Contractor shall provide wiring and conduit from the pressure sensor to the pump control package.

.4 One pump (lead pump) shall operate continuously at various speeds to maintain the set point pressure. When the system demand exceeds the Best Operating Point (BOP) of the lead pump or the system pressure is not being satisfied, the second pump (lag pump) shall be automatically started. BOP shall be determined by current sensing.

.5 A similar sequence of events shall take place in reverse on

decreasing demand.

.6 Pump RPM shall be controlled by a Variable Frequency Drive (VFD) connected directly to each individual pump motor. An analog signal from the discharge pressure transmitter shall be compared to a desired set point entered in to the operator panel. The pump logic controller shall instruct the VFD to either speed up or slow-down in order to meet or maintain the system set point pressure.

.7 Sequential starting and stopping of the pumps is achieved by a combination of pump BOP or set point pressure. The pump BOP shall be determined based on factory tests as well as pump operating differential pressure. The pump BOP values shall be factory set and shall be accessible in the Set-Up screen of the operator panel. A default restore button shall be included in the setup page to return settings to factory conditions at any time. A set point pressure control will bring on a lag pump if the lead pump is operating at full speed and once the lead pump exceeds it's best-operating-point (BOP) the first lag pump shall start following a 10 second time delay.

.8 Once the lag pump is called on, a minimum run timer (MRT) shall begin counting to ensure that the pump runs for a minimum of 5 minutes. The MRT shall be adjustable.

.9 When the 2 pumps are running and are operating at a point below the BOP and the lag pump minimum run timer having timed out, the lag pump shall ramp down its speed and turn off. The lead pump will continue to operate and meet system requirements based on the set point pressure. Steps 2-5 are repeated in order to satisfy the building requirements.

.10 The lead pump shall alternate every 24 hrs based via an adjustable real time clock. A time clock shall bring on the second pump, for a period of 5 seconds both pumps will operate at which point the first pump on will be shut off.

.11 An Aquastat connected to the pump seal chambers shall monitor the water temperature and when the water temperature reaches its high limit setpoint the pump shall be shut off. Pump shall restart when there is a 5psi pressure drop in the system pressure. When the pump is shut off due to high temperature a red indicator light shall be lit on the control panel.

.12 The system shall be manually operated by means of the virtual HOA selector buttons provided on the touch screen operator interface.

.11 Low Flow Stop Function

.1 The system controller shall be capable of stopping pumps during periods of low-flow or zero-flow without wasting water or adding unwanted heat to the liquid. Temperature based no flow shut-down methods that have the potential to waste water and add unwanted temperature rise to the pumping fluid are not acceptable.

.2 A bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When only one pump is in operation the system controller shall be capable of detecting low flow (less than 10% of pump nominal flow) without the use of additional flow sensing devices.

.3 When a low flow is detected, the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band). The pump shall remain off until the discharge pressure reaches the start

pressure (system set-point minus 50% of programmed on/off band). Upon low flow shut-down a pump shall be restarted in one of the following two ways:

.1 Low Flow Restart:

.1 If the drop in pressure is slow when the start pressure is reached (indicating the flow is still low), the pump shall start and the speed shall again be increased until the stop pressure is reached and the pump shall again be switched off.

.2 Normal Flow Restart:

.1 If the drop in pressure is fast (indicating the flow is greater than 10% of pump nominal flow) the pump shall start and the speed shall be increased until the system pressure reaches the system set-point.

.2 It shall be possible to change from the standard low flow stop to the optional low flow stop (and vice-versa) via the user interface.

.12 Factory Prefabrication

.1 The system shall be factory prefabricated, including isolation ball / butterfly valves on the suction and discharge of each pump as well as headers sized for the flow rate indicated in the schedule. Stainless steel construction with flanged connections.

.2 The only field connections required shall be piping to the system headers, piping to the buffer tank and one incoming power connection at the control panel.

.3 Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 50mm and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 75mm and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.

.4 A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the valve shall not exceed 5 psi at the pump design capacity. Check valves 40mm and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 50mm and larger shall have a body material of stainless steel or epoxy coated iron (fusion bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.

.5 A minimum diaphragm tank connection size of 20mm shall be provided on the discharge manifold.

.6 A pressure transducer shall be field installed at the top of the building. Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.

.7 A bourdon tube pressure gauge, 63.5mm diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid

filled and have copper alloy internal parts in a stainless steel case. The gauge shall be capable of a pressure of 30% above it's maximum span without requiring recalibration.

.8 Systems with a flooded suction inlet or suction lift configuration shall have a factory installed water shortage protection device on the suction manifold.

.9 The base frame shall be constructed of corrosion resistant 304 stainless steel.

.10 Type M1 vibration dampers shall be fitted between each pump and base frame to minimize vibration.

.11 The controller panel shall be mounted on the front of the unit on a 304 stainless steel fabricated control cabinet stand attached to the system skid.

.12 All water piping on the skid shall be factory insulated.

.13 Factory Test and Certification

.1 The booster system and its component parts shall undergo a complete operational flow test from zero to 100% design flow rate under the specified suction pressure conditions. The system certification shall include copies of the test data as certified by a factory engineer.

.2 The system shall undergo a hydrostatic test of 1724 kPa for a minimum of 15 minutes prior to shipment.

.3 Performance test certifications to be placed inside the control panel and extra copies with installation manual. In addition, the entire system shall be third party certified by Underwriters Laboratories Inc. In accordance with OSHA 29 CFR with references to nationally recognized testing laboratories.

.14 Warranty

.1 The warranty period shall be a non-prorated period of 24 months from date of Substantial completion , not to exceed 30 months from date of manufacture.

2.5 CIRCULATING PUMPS

.1 Capacity: As shown on the pump schedules.

.2 Construction: Closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, SS or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearing. Design for 860 kPa and 105°C (125 psi & 230°F) continuous service.

.3 Motor: Drip-proof, thermal overload protection.

.4 Supports: provide as recommended by manufacturer.

2.6 WELL PUMP

.1 Capacity: As shown on the pump schedules.

.2 Submersible pump installed in the well with continuous casing shall be equipped with a torque arrestor fastened to the drop pipe within 300mm of pump. Drop pipe shall be minimum 32mm (1.25”)ID and shall be CSA-rated to a minimum 1034 kPa (150 psi).

.4 Bottom of submersible pump shall be installed above the well screen and a minimum of 3m (10 ft) above the bottom of the well but a minimum of 2.7 m (8 ft) below the maximum drawdown groundwater level after the drawdown test has been completed.

.5 Drop cable shall be minimum 12-gauge THW flat-jacketed submersible pump cable. Drop cable shall be secured with cable ties to the drop pipe at no more than 1m (3.2’) intervals. Drop cable shall be spliced to the pump motor leads with crimp-style connectors and heat-shrink tubing. Drop cable shall extend a minimum of 3m (10’) beyond the top of the well cap.

.6 Stainless steel safety cable shall be used to secure the submersible pump to the ventilated well cap. Cable shall be held secure using 2 swaged crimp-type sleeves at each end. Cable length shall be sufficient to extend from pump at installed depth to a minimum 3m (10’) above the top of the well casing to allow for removal of well cap.

.7 Pump Construction:

.1	Discharge head:	303 Stainless Steel
.2	Shaft:	304 Stainless Steel
.3	Shaft couplings:	304 Stainless Steel
.4	Motor Adapter:	303 Stainless Steel
.5	Casing:	304 Stainless Steel
.6	Suction Screen:	304 Stainless Steel
.7	Bowl:	304 Stainless Steel
.8	Impeller:	Glass Filled Engineered Composite
.9	Diffuser:	Glass Filled Engineered Composite

.8 Pump shall be installed in a flow sleeve to maintain a minimum flow rate for optimum service life.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

.3 Set up and adjust all controls.

.4 Sump Pumps

.1 Provide ball or butterfly valve, check valve and union, or flange as applicable on pump discharge pipes and union or flange as applicable

on vent pipe for sanitary pits.
.2 Check valves downstream of pumps shall be swing type with external lever and adjustable weight.
.3 Align vertical pit mounted pump assembly after mounting and securing cover plate.

.5 Domestic Cold Water Booster
.1 Mount domestic cold water booster pump package on a 100mm (4”) housekeeping pad.
.2 Mechanical Contractor to provide conduit and wiring from the supply pressure sensor to the pump control package.
.3 Start-Up
.1 Manufacturer’s representative shall start up and provide start up report for the Pressure Booster Pump Package.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers International (ASME)
.1 ASME B16.15-2018, Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
.2 ASME B16.22-2018, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
.3 ASME B16.18-2018, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International Inc. (ASTM)
.1 ASTM A307-14el, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.2 ASTM B88M-18, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American Water Works Association (AWWA)
.1 AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International)
.1 CSA B242-05(R2016), Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus)
.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015)
.1 Safety Data Sheets (SDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
.1 MSS-SP-67-2017, Butterfly Valves.
.2 MSS-SP-70-2011, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71-2018, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction
.1 NRCC 47668, National Plumbing Code of Canada (NPC) - 2015.

.9 Transport Canada (TC)
.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.
.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Cast bronze threaded fittings, Class 125: to ASME B16.15.

.2 Cast copper, solder type: to ASME B16.18.

.3 Wrought copper and copper alloy, solder type: to ASME B16.22.

2.3 JOINTS

.1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111/A21.11.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 ALL VALVES

.1 GROOVED END BUTTERFLY VALVES
.1 NPS 65mm (2 ½") and over, grooved ends:
.1 Class 300, bubble tight shut off to 2065 kPa bronze body.
.2 Operators:
.1 NPS 100mm (4") and under, lever handle
.2 NPS 150mm (6") and over, gear operated.
.2 NPS 2 ½ and over, grooved ends Stainless Steel
.1 Grade CF8M stainless steel body and disc, 316 stainless steel stem, PTFE impregnated glass fabric bearings with 316 stainless steel backing, with synthetic rubber seal. (Grade to suit the intended service.) Valve stem shall be offset from the disc centerline to provide full 360-degree circumferential seating. Bubble-tight, dead-end or bi-directional service to 300 psi (2065 kPa)
.2 Operators:
.1 NPS 100mm (4") and under, lever handle

.2 150mm (6″) and over, gear operated.

.2 GLOBE VALVES
.1 NPS 50mm (2″) and under, balancing, soldered:
.1 To MSS SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.
.2 Lockshield handles: as indicated.
.1 NPS 50mm (2″) and under, balancing, screwed:
.1 To MSS SP-80, class 125, 860 kPa, bronze body, screwed over bonnet, renewable composition disc.
.2 Lockshield handles: as indicated.

.3 SWING CHECK VALVES
.1 NPS 50mm (2″) and under, soldered:
.1 To MSS SP-80, class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
.2 NPS 50mm (2″) and under, screwed:
.1 To MSS SP-80, class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
.3 NPS 65mm (2 ½″) and over, flanged: - NSF/ANSI 372 compliant
.1 Working pressure 300psi, ductile iron epoxy coated body, Bronze ASTM B62 seat ring, ductile iron epoxy coated disc, bolted bonnet.

.4 BALL VALVES (NSF/ANSI 372 Compliant)
.1 NPS 50mm (2″) and under, branch isolators, screwed:
.1 600 WOG, brass body C49300, solid stainless steel ball, PTFE packing or double “o” ring design, blowout proof stem, lever handle.
.2 Ball valves shall have full port opening.

.5 GROOVED END BALL VALVES (NSF/ANSI 372 Compliant)
.1 1000 psi rated, CF8M stainless steel body, 316 stainless steel ball and stem, RTFE seats, reinforced fluoroelastomer seals, standard port, two-piece valve.

.6 BUTTERFLY VALVES
.1 NPS 65mm (2 ½″) and Over Grooved End Pipe
.1 Grooved end butterfly valves shall have dual seal disc providing bubble tight service up to 2068 kPa. Ductile iron body conforming to ASTM A 536, Grade E EPDM disc coating. EPDM disc coating with stainless steel trim.
.2 Utilize for all on/off applications up to 1380 kPa operating pressure.
.3 Valves to be bubble tight shutoff up to 1380 kPa rating if downstream equipment is removed. (full dead end service)
.4 Operator
.1 NPS 150mm (6″) and under: lever handle.
.2 NPS 200mm(8″) and over: gear operated
.2 NPS 65mm (2 ½″) and Over Full Lug Body (1380 kPa)
.1 NSF/ANSI 372 compliant, lug type, MSS SP 67, 1380 kPa WOG water, cast iron or ductile iron body with A351 CF8M (austenitic stainless steel) disc, 416 stainless steel stem, EPDM liner. Lugs shall be tapped. Valves to be bubble tight shutoff up to 1380 kPa rating if downstream equipment is removed. (full dead end service)
.2 Utilize for all on/off applications with operating pressures 1380 kPa and less.
.3 Operator
.1 NPS 150mm (6″) and under: lever handle.

.2 NPS 200mm (8”) and over: gear operated

.7 AUTOMATIC CIRCUIT BALANCING VALVES

.1 Circuit balancing valves shall be of the automatic variety. Manual circuit balancing valves will not be accepted.

.2 Circuit Balancing Valves are required on the domestic hot water recirculation system.

.3 Provide the following sizes:

.1 Provide 0.032 l/s for 12 mm pipe size.

.2 Provide 0.063 l/s for 20 mm pipe size.

.4 Product Warranty and Performance Guarantee

.1 Valves shall be warranted by the manufacturer to be free of defects in material and workmanship for a period of five years.

.2 Valves shall control flow to within plus/minus 5 percent of design over an operating differential range of at least 14 times the minimum required for control. Four operating pressure ranges shall be available with the minimum range requiring less than 20.7kPa (3 psid) to actuate the mechanism.

.3 The valve flow curve shall be smooth over its entire nominal control range. Gaps, bumps and dips in flow curves shall not be acceptable.

.5 Shop Drawing Submission

.1 The Balancing Valve Manufacturer shall submit a complete list of balancing valves, their location and their performance.

.2 The Balancing Valve Manufacturer shall mark up a set of full size plans showing the location of each balancing valve and assign an appropriate identification tag for the balancing valve.

.3 The Balancing Valve Manufacturer shall submit these drawings for the Departmental Representative to review, incorporate any comments from the Departmental Representative and then submit copies of this drawing to the Mechanical Contractor, Departmental Representative and Construction Manager.

.4 All balancing valves shall be shipped to site with this tag number firmly attached to the valve and the full size drawings shall be utilized to identify the location where they are to be installed.

.6 Valve Flow Control Cartridge (Typical for all valves)

.1 The non adjustable flow control cartridge shall be 100% type 304 stainless steel. Parts made of soft metals such as brass with only a coating of hard metal such as nickel shall not be allowed. Rubber based materials whose properties change with temperature and pressure shall not be allowed.

.2 The cartridges shall have segmented ports through which water can pass, rather than a continuous large port, to eliminate noise and full travel linear coil spring.

.3 The cartridge movement shall result in a shearing action that will dislodge or shear any particle that may tend to get stuck in a port.

.4 Cartridge shall be removable from the housing and shall be held in place in the housing without adhesive.

.5 All flow control cartridges shall be warranted by the manufacturer for five years from the date of sale.

.7 Sizes 40mm and smaller

.1 Valves shall have forged “lead free” brass bodies and type 304 stainless steel cartridge assembly rated for a minimum of 2757 kPa and 121 C (400 psi at 250 F).

.8 Valve end connections shall be either female sweat or FPT.

.9 Valves shall be provided with two pressure/temperature taps.

.10 Valves shall be provided with a union tailpiece and built in isolation valve.
.11 The body design shall allow for inspection or removal of the cartridge without disturbing piping connections.
.12 The valve shall come fully assembled and shall be permanently marked to show direction of flow and shall have a body tag to indicated flow rate and model number.
.13 Provide a shut off valve upstream of the valve to allow the system to be shut off and the balancing valve to be removed without shutting down the entire heating system.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with NPC, and local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ASME standards.

.3 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.5 Buried tubing:
.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

3.4 PRESSURE TESTS

.1 Test pressure: greater of one (1) times maximum system operating pressure or 860 kPa.

3.5 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International Inc.(ASTM)
- .1 ASTM B32-08(2014), Standard Specification for Solder Metal.
- .2 ASTM B306-13 Standard Specification for Copper Drainage Tube (DWV).
- .3 ASTM C564-20a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).
- .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
- .2 CSA B70:19, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .3 CSA B125.3-18, Plumbing Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary storm and vent Type DWV to: ASTM B306.
- .1 Fittings.
  - .1 Cast brass: to CSA B125.3.
  - .2 Wrought copper: to CSA B125.3.
- .2 Solder: tin-lead, 50:50, type 50A.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above grade sanitary, storm and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating of bitumous coating.
- .1 Joints:
  - .1 Mechanical joints:
    - .1 Neoprene or butyl rubber compression gaskets: to CSA B70. ASTM C564 or
    - .2 Stainless steel clamps.
  - .2 Hub and spigot:
    - .1 Caulking lead: to CSA B67.
    - .2 Cold caulking compounds.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:
- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.4 Affix applicable label (sanitary, vent, etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International Inc. (ASTM)
- .1 ASTM D2235-04(2016), Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- .2 ASTM D2564-12(2018), Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .3 ASTM D2665–14, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- .4 ASTM D2949–18, Standard Specification for 3.25-in. Outside Diameter Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- .5 ASTM B251/B251M–17, Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- .6 ASTM D3034–16, Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
- .7 ASTM F891–16, Standard Specification for Coextruded Poly Vinyl Chloride (PVC) Plastic Pipe With a Cellular Core.

.2 Canadian Standards Association (CSA International)
- .1 CSA B1800-18, Thermoplastic Non-pressure Piping Compendium.
  - .1 CSA B181.2-18, PVC and CPVC drain, waste, and vent pipe and pipe fittings.
  - .2 CSA B182.1-18, Plastic Drain and Sewer Pipe and Pipe Fittings.

.3 Green Seal Environmental Standards (GSES)
- .1 Standard GS-36-13, Commercial Adhesives.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015)
- .1 Safety Data Sheets (SDS).

.5 South Coast Air Quality Management District (SCAQMD), California State
- .1 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
- .1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Provide two copies WHMIS SDS - Safety Data Sheets.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by manufacturer.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates padding and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Adhesives and Sealants: in accordance with Section 07 92 00.

2.2 SANITARY DRAINAGE AND VENTS

.1 General
.1 All sanitary drainage above ground shall be cast iron as specified in Section 22 13 17. No plastic piping shall be utilized above grade with the exception of piping connections to Urinals.

.2 Piping And Fittings
.1 For buried sanitary, storm and vent piping:
.1 ASTM D2665, ASTM D2949, ASTM B251.
.2 ASTM D3034, ASTM F891.
.3 CSA B181.2 for PVC DWV or
.4 CSA B182.1 for plastic DWV.
.2 Joints
.1 Solvent weld for PVC: to ASTM D2564.
.2 Solvent weld for ABS: to ASTM D2235.
.3 For sizes above 100mm (4").
.1 Provide Ring-Tite joints Canron Ring-Tite joints PVC DR35 gravity sewer pipe, with locked in rubber ring sealing feature providing tight flexible seal.
.2 Spigot ends to be supplied complete with bevel.
.3 All PVC piping below grade shall be a minimum of SDR 35.

PART 3 – EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install buried pipe on 150mm (6") bed of clean sand, shaped to accommodate hubs and fittings, to line and grade as indicated. Backfill with clean sand. In addition to other requirements, backfill must comply with environmental quality requirements in Subsection 1.10 of Section 01 35 13.43.

.2 Install piping parallel and close to walls to conserve space and to grade indicated, and to suit the installation of related work.

.3 Apply solvent to male end of joints only.

.4 Pipe installation: Pipe shall be installed as specified and indicated on the drawings.

.5 The piping system shall be installed in accordance with the manufacturers current published installation procedures.

.6 PVC piping shall not be utilized above grade. The PVC piping shall convert to cast iron prior to the point where it penetrates the floor slab.

.7 Where piping passes through floor or wall below grade pack and seal in concrete in accordance with specification Section 22 05 00.

.8 Provide venting to all plumbing fixtures and fixture groups in accordance to the National Building Code, National Plumbing Code and local authorities having jurisdiction.

.9 If tests are required by an authority having jurisdiction, perform tests in presence of each governing authority and obtain certification. Repeat tests as often as necessary to obtain certification.

.10 Test pressure shall not exceed 1-1/2 times the maximum rated pressure of the lowest related element in the system.

.11 Remove all fittings which do not withstand test pressure, replace and retest.

.12 Eliminate leaks, or remove and refit defective parts.

3.3 CAMERA INSPECTION AND CLEANING

.1 When the sanitary and storm drainage systems below grade are complete and prior to the concrete pour for the floor, the drainage piping shall be flushed and cleaned and a camera inspection shall be undertaken to confirm that the pipe is free from blockage and all pipes are properly connected.

.2 The videotape/DVD of the camera inspection is to be submitted to the Departmental Representative for review. In addition to the DVD/videotape a marked up drawing identifying areas where there are problems/issues is to be submitted.

3.4 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.5 PERFORMANCE VERIFICATION

.1 Test to ensure traps are fully and permanently primed.

3.6 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)
.1 ANSI Z21.10.1-2017/CSA 4.1-2017, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
.2 ANSI Z21.10.3-2017/CSA 4.3-2017, Gas-Fired Water Heaters, Volume III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

.2 Canadian Standards Association (CSA International)
.1 CSA B51:19, Boiler, Pressure Vessel, and Pressure Piping Code.
.2 CSA B139 Series-19, Installation Code for Oil Burning Equipment.
.3 CSA B140.0-03(R2018), Oil Burning Equipment: General Requirements.
.4 CSA B140.12-03(R2018), Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.
.5 CAN/CSA C22.2 No.110-94(R2018), Construction and Test of Electric Storage Tank Water Heaters.
.6 CAN/CSA C191-13(R2018), Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service.
.7 CSA C309-M90(R2019), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

.3 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
.1 ASHRAE 90.1-2019 (SI), Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate:
.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

1.5 WARRANTY

.1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions is extended to 5 years specified for each product.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER HEATER - ELECTRIC

.1 Refer to schedule in drawing M003 for hot water heater capacity and power voltage required.

.2 Water heaters shall meet CAN/CSA-C191 and ASHRAE 90.1 requirements.

.3 Tank shall have a working pressure rating of 1000 kPa (150 psi) and shall be tested to withstand a hydrostatic pressure of 2000 kPa (300 psi).

.4 The heating element shall be composed of Nichrome imbedded magnesium oxide and sealed in seamless copper tube. Element shall be in direct contact with the water.

.5 Unit shall be provided with a magnesium anode rod.

.6 Unit shall be provided with a unit mounted electrical junction box.

.7 Water heater shall be completely factory assembled, including an ASME rated, temperature/pressure relief valve.

.8 Complete unit shall be insulated with a blanket of heavy duty fibreglass.

.9 Hot water heater shall be provided with the following:
.1 Heater tank shall have a 5 year warranty.
.2 Fully adjustable from 48.9 C (120 F) to 82.2 C (180 F) operating thermostat.
.3 High temperature limiting device which shall shut off the element if the preset temperature is exceeded.
.4 Dielectric nipples.
.5 Ball drain valve.
.6 Baked enamel finish over a bonderized undercoating.
.7 Surface Mounted Thermostat with integral ECO. Provide one per element.

2.2 INSTANTANEOUS ELECTRIC HOT WATER HEATER

.1 Unit shall have ABS-UL 94V0 rated cover. Element shall be replaceable cartridge insert. Unit shall have replaceable filter in the inlet connector. Element shall be iron free, Nickel Chrome material.

.2 Heater shall be fitted with 12mm (1/2") pipe compression fittings 16mm (5/8" OD) on bottom of unit to eliminate need for soldering. Maximum operating pressure of 1034kPa (150 PSI). Hot water storage tanks prohibited.

.3 99% Thermal Efficiency. Microprocessor Temperature Control for Thermostatic Accuracy +/-1°F. Fully adjustable temperature range between 37.8-60°C (100-140°F). Factory preset to 43.3°C (110°F) WITH 1.1 Lpm (0.3 GPM) turn on for metering faucets. Maximum operating pressure of 1034kPa (150 PSI).

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for horizontal mounted tanks and for instantaneous heaters.

.3 Provide insulation between tank and supports.

.4 Connect domestic water heater to cold water supply and domestic hot water supply connections as indicated.

.5 Pipe pressure and temperature relief valve to drain.

.6 Provide structural steel for support as required.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 00.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 00.

.2 All components of Domestic Cold Water Treatment package shall be supplied by one (1) manufacturer.

1.2 REFERENCE STANDARDS

.1 National Sanitation Foundation (NSF)/ American National Standards Institute (ANSI)/ National Standard of Canada (CAN)
.1 NSF/ANSI/CAN 61-2020, Drinking Water System Components - Health Effects and requirements.
.2 NSF/ANSI 55-2019, Ultraviolet Microbiological Water Treatment Systems.
.3 NSF/ANSI 372-2016, Drinking Water System Components - Lead Content.

.2 Underwriter Laboratories (UL)
.1 UL 979-2016, Standard for Safety Water Treatment Appliances

.3 National Electrical Manufacturers Association (NEMA)
.1 NEMA Ratings for Enclosures

.4 Local Authority Having Jurisdiction.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 23 05 00.

1.4 MAINTENANCE AND ENGINEERING DATA

.1 Provide maintenance data for incorporation into maintenance manual specified in Section 22 05 02 and 23 05 00.

PART 2 - PRODUCTS

2.1 IRON/SULFUR FILTER PACKAGE

.1 Provide single tank Iron and Sulfur filter package which utilizes aeration process to oxidize dissolved iron and hydrogen sulfide to filterable particles without using any chemicals. Exterior Tank shall be made of sturdy fiberglass media with filament-wound and inner tank shell shall be smooth non-permeable, designed for continual service. Package shall include inlet and air line check valves, a stainless steel strainer on the air intake, bypass valve, meter to monitor and record daily water usage and retains regeneration data, back-lit display with digital clock to indicate working of filter and warns for system malfunctions. Valves shall be non-corrosive and pistons shall be motor-driven. The package shall be automatic.

System	Unit	Service Flow	Media	Control Valve	Total Height	Tank Height	Tank Diameter
Iron/ Sulfur	250mm (10″)	18.9 Lpm (5 gpm) @ 5ppm Iron/ Hydrogen Sulfide	2 Layers plus gravel/ Catalytic Carbon	25mm (1″)	1750mm (69″)	1370mm (54″)	250mm (10″)

2.2 WATER SOFTENER PACKAGE:

.1 Vertical pressure type water softener system complete with pressure vessel, softening resin, control valve, brine maker and electronic controller. The system will be of an approved design as fabricated by a manufacturer regularly engaged in the production of water treatment equipment. All equipment and material shall be supplied in compliance with the specifications as intended for a complete and operational system.

.2 Single automatic water softener shall remove mineral hardness to a level not to exceed 17.1 mg/L when the system is operated at 37.9Lpm (10 gpm) and in accordance with the operating instructions. The system shall capable of supplying 11130 liter (2940) gallons of softened water between regenerations based on the influent water analysis listed below. The systems performance shall be rated at a design flow rate of 37.9Lpm (10 gpm) with a rated pressure drop of 85.5kPa (12.4 psi), and shall be capable of a peak flow rate of 41.6Lpm (11 gpm) for sustained periods of 90 minutes with a pressure drop of 103.4kPa (15 psi).

.3 PERFORMANCE AND DESIGN DATA

.1 INFLUENT WATER ANALYSIS
- .1 Total Hardness: 273.6mg/L (16 gpg)
- .2 Eff. Hardness @ 100% Cap.: 0 mg/L
- .3 Calcium, Ca: 0
- .4 Magnesium, Mg: 0
- .5 Iron, Fe: 0.05
- .6 Turbidity, NTU: 0
- .7 Total Dissolved Solids, TDS: 945
- .8 pH: 7.2
- .9 Manganese, Mn: 0
- .10 Color: 0

.2 DESIGN PARAMETERS (Each Unit)
- .1 Normal System Flow & Pressure Drop: 35.6Lpm @ 80.7kPa (9.4 gpm @ 11.7 psi)
- .2 Maximum System Flow & Pressure Drop: 41.6Lpm @ 103.4kPa (11 gpm @ 15 psi)
- .3 Backwash/Rinse Flow: 9.5Lpm (2.5 gpm)
- .4 Backwash Volume: 261L (69 gallons nominal)
- .5 Daily Water Usage: 18170 Liter per day (4800 gpd)
- .6 Operating Temperature Range: 0.6 – 49 °C (33 - 120 °F)
- .7 Operating Pressure Range (System): 138 – 862 kPa (20 - 125 psi)
- .8 Electrical Requirements: 24 Volts AC, 60 Hz, 1 Ph
- .9 System Dimension (W x H x D): 890x 1575x400 (35x62x16″) media and brine tank

.4 Softener Tank:

.1 Tank shall be manufactured of polyester reinforced by a continuous roving glass filament overwrap. The top opening shall be 100 – 200mm (4 – 8″) UN threaded and the tank bottom shall be supported on a molded structural base. Each softener tank shall be 250mm (10in) in diameter. The overall tank height (less base) shall be 1370mm (54in), sufficient to allow for a proper freeboard space above the resin bed for adequate expansion of the resin during backwashing. Each tank shall be equipped with openings for mineral filling and periodic inspection.

.2 Internal Distribution:

.1 The upper distribution system shall be of the single point diffuser type to dispense water laterally to avoid channeling within the resin bed.

.2 The lower distribution system shall be single point distributor type, constructed of PVC pipe and a fine slotted strainer to provide even flow distribution through the resin bed. The distribution system shall be embedded in a two layer subfill of washed inorganic material to support the resin bed.

.3 Main Operating Valve:

.1 The main operating valve shall be top mount design constructed of thermoplastic to resist attack by substances found in natural water supplies. Inlet and outlet connections to be 25mm (1″) NPTE

.2 The main operating valve shall be motor driven, mechanically activated design with six (6) positions to accomplish the regeneration steps of backwash, brine draw/rinse, fast rinse and brine refill in addition to the service position. The internal seals shall be modular design for ease of replacement and service.

.3 A bypass valve of 25mm (1") NPT connections shall be included with the softener, constructed of reinforced thermoplastic, allows water to bypass the softener for uses not requiring softened water.

.4 Controls:

.1 A fully integrated programmable microprocessor driven electronic controller shall be provided to automatically cycle the main operating valve through the regeneration sequence. The electronic controller shall be designed and manufactured by the same manufacturer as the water treatment equipment.

.2 The controller shall be capable of initiating a regeneration by accepting an internal signal from the controller time keeping device; an external Hall-Effect flow sensor, aqua-sensor, an external device such as a remote start push-button or any combination of these methods. The controller shall sequence all steps of an automatic regeneration and automatically return the softener to a service or stand-by mode. The initiating time and/or volume setpoints shall automatically reset upon completion of the regeneration sequence.

.3 The controller shall include a sealed keypad, capable of programming all controller functions, located on the face of the controller. The controller display shall be a multi-line OLED display capable of full text readouts of operating status and codes.

.4 An audible alarm beeper capable of emitting a tone of ~70 dBA shall be available but capable of being disabled if so desired.

.5 The controller shall allow for a manual initiation of the automatic regeneration sequence by utilizing a regeneration selection from the controller menu.

.6 The controller shall operate on a low voltage electrical system. The system shall include a UL/CUL listed transformer. The entire

electronic control package and its associated inputs/outputs shall require not more than 24 VAC @ 50VA. The control shall be rated for web environments and certified to NEMA 3R.

.7 The controller shall utilize EEPROM to save pertinent programmed data and statistical functions. The controller must retain all functionality for power interruptions of less than 72 hours. A battery backup shall be installed and capable of maintaining the time of day for a minimum of 5 years.

.8 System Controls:

.1 An operator selected program of immediate or delayed hardness initiated regeneration for single units shall be available. An aqua-sensor control probe will be inserted into the resin bed and will sense the need for regeneration based on electrical impedance within the resin bed and will signal the circuit board to initiate regeneration after a continuous 6 minute increase in impedance ratio. The system will compensate for variations in water hardness and temperature and will require no field adjustments when operated within the normal temperature range of the softener. The controller shall be capable of being programmed in the field without additional interface devices. The controller shall indicate various data that includes number of regenerations in the last 14 days, days since the last regeneration, total number of regenerations for the life of the unit, last slow rinse time, time of day, and unit in regeneration.

.2 Regeneration sequence timers: The controller shall allow control customization of individual regeneration cycle times, each programmable from 1 - 99 minutes. The regeneration cycle and time of cycle remaining shall be displayed when in regeneration.

.3 Lockout function: The controller shall include a lockout to prevent unauthorized personnel from altering program data.

.4 Regeneration override: The controller shall include a function to direct pre-programmed regeneration after a user determined period of time (hours or 24 hour intervals) without an input signal from another regeneration initiation device.

.5 Alarm status indicator: The controller shall monitor operation of internal functions. If a fault is identified, the need for operator intervention will be signaled visually within the controller display.

.6 Two Auxiliary Outputs: Two Auxiliary Outputs shall be integral to the controller circuit board. Each Output shall be capable of being programmed to provide power to a "Normally Open" or "Normally Closed" contact (user choice). These 24VAC outputs shall be used only for the purpose of energizing a relay coil.

.7 Flow rate indication: The controller shall be capable of indicating the flow rate of the treated water.

.8 Totalizer: The controller shall include a totalizer function and a display capacity to 99,999,999 units before resetting to zero. The totalizer value shall be displayed through the controller display during operation.

.9 Flow Sensor(s):
.1 Each softener will include a turbine-type Hall Effect flow sensor.
.2 The sensor shall be integral to the control valve. A cable shall be provided for direct connection to the system controller.
.3 The flow sensor package provided shall be functional within the flow range of 1.9 to 227 Lpm (0.5 to 60.0 gpm).
.4 The flow sensor shall have an accuracy to 2% over full range.

.5 Exchange Resin:
.1 The ion exchange resin shall be virgin high capacity standard mesh of sulfonated polystyrene type stable over the entire pH range with good resistance to bead fracture from attrition or osmotic shock. Each cubic foot of resin shall be capable of removing 30000.0 grains of hardness as calcium carbonate when regenerated with 6.8kg (15.0 lbs) of salt. The resin shall be solid, of the proper particle size of 400x1000 (16x40”) mesh, U.S. standard screen and will contain no agglomerates, shells, plates or other shapes that might interfere with the normal function of the water softener.
.2 The system shall include 42.5L (1.5 cubic feet) of exchange resin per vessel and a total of 42.5L (1.5 cubic feet) of resin for the system.

.6 Brine System
.1 Provide a complete brine system consisting of a plastic tank, cover, salt platform, brine well, an automatic brine valve and all necessary fittings for operation with the water softening system. The system shall consist of a combined brine measuring and salt storage tank with salt platform. The tank shall be sized 450 x 950mm (18 x 38”), the system shall include a total of one (1) brine tank that can hold 170kg (375 lbs) of salt.
.2 The brine tank shall be equipped with a float operated non-corrosive field serviceable brine float valve for automatic control of brine withdrawal and fresh water refill.
.3 The brine valve shall automatically open to admit brine to the resin tank during eduction and close automatically providing positive shut-off to prevent air from entering the system. The brine valve shall also regulate the flow of soft water into the brine tank during refill. The brine valve shall work with the timed fill feature of the main operating valve controls to admit the correct volume of fresh water to the brine tank in accordance with the refill time setting in the control program. The brine valve shall include a float operated safety shut-off valve as a back up to the timed refill from the main operating valve control to prevent brine tank overflow.

2.3 UV FILTER

.1 The body shall be anodized aluminum and 316 stainless steel, double door with side hinges, 25mm (1") MNPT Stainless Steel inlet/outlet ports, ingress Protection rating 51.

.2 The system shall conforms to NSF/ANSI 55 for the disinfection of microbiologically contaminated water that meets all other public health standards.

.3 The unit shall be plugged into a 120Vac ground-fault circuit-interrupter (GFCI).

.4 The system shall incorporates both audible and visual alarms to indicate system status. It shall have built-in automatic mechanical wiper quartz sleeve cleaning, wiper position switch, purge valve, forced air cooling, internal flow restrictor, normally closed automatic solenoid valve to shut off the water supply in the event of a system fault and an automatic quartz cleaning feature to eliminate the periodic maintenance.

.5 Wetted parts shall meet NSF/ANSI/CAN 61 & NSF/ANSI 372 for water up to 23°C (73°F).

.6 Operating Range:
- .1 Flow (single unit): Up to 62.5 Lpm (16.5 gpm)
- .2 UV dose: Min. 40 mJ/cm2
- .3 UV Transmittance [UVT] (water): Minimum 75% UVT
- .4 Hardness (water): Maximum 855 mg/L (50 gpg)
- .5 Iron (water): Maximum 3 mg/L (3 ppm)
- .6 Temperature (air and water): 1 - 40°C (34 - 104°F)
- .7 Water pressure: 34 - 690 kPa (5 - 100 psig)
- .8 Relative humidity (air): Maximum 70%

.7 The unit shall be UL 979 certified, shall have air mounted UV lamps with typical lamp life of 9,000 hours and maximum 2 per 24 hours Lamp cycles, Dual UV calibrated sensors, built-in dry contacts for warning and alarm, Colour LCD resistive touchscreen display, Indicator light and audible alarms, built-in Remote start/stop, built-in Onboard diagnostics and 4-20mA Output.

2.4 REVERSE OSMOSIS PACKAGE AT POINT OF USE

.1 Reverse Osmosis system shall include Particle Filter, Activated Carbon Filter, Reverse Osmosis Membrane, Specialty Filter, Storage Tank and Polishing Filter.

.2 Specialty media cartridges must be installed after the RO membrane and system must have a Performance Indicator Device (PID) installed to track gallon usage.

.3 Pre-filtration (sediment filtration and carbon filtration) shall reduce the large contaminants from the water before they reach either the reverse osmosis.

.4 The reverse osmosis membrane shall utilize a tightly woven membrane that acts as a barrier to contaminants. Water shall pushed up against this membrane at pressure. Reverse Osmosis shall reduce up to 99% of contaminants.

.5 The advanced filtration cartridges shall reduce contaminants that reverse osmosis membranes are not efficient in removing.

.6 The Total Defense cartridge shall be added to the system to deal with lead, mercury, aesthetic chloramines, aesthetic chlorine taste and odor, cysts, Volatile Organic Compounds (VOC) and MTBE.

.7 The Mineral Boost cartridge shall add healthy amounts of natural calcium minerals back into reverse osmosis water to create healthy taste, optimally alkaline, pH balanced water. It shall raise RO water TDS by 20 ppm to 30 ppm and pH by 1 to 2 pH.

.8 Performance and design data:
- .1 Reverse Osmosis Membrane: Thin Film Composite

.2 Specialty Filter: 1000 gallons
.3 Storage Tank and Dimensions DxH: 10.5 L (3 gallons); 28 x 38 cm (11″ x 15″)
.4 Polishing Filter: Activated Carbon or Carbon Block
.5 Maximum operating pressure: 827kPa (120 psi)
.6 Ratio of Product to flush flow: 1:3 – 1:5
.7 Filter Assembly Dimensions WxDxH: 35 x 10.7 x 39.4 cm (13.8″ x 4.2″ x 15.5″)

2.5 CONTROLS

.1 Provide three pressure switches.

.2 Provide a Control Panel that shall control the following pieces of equipment:
.1 Booster Pump Package (P-01A and P-01B).
.2 Storage tank circulator, pump P-02.
.3 One (1) control valve.
.4 Ultrasonic Level Sensor
.5 Well Pump.

.3 This Control Panel shall also receive inputs from the following pieces of equipment:
.1 Pressure switches.
.2 Four (4) relays from Ultrasonic Level Sensor.

.4 Control Panel shall be enclosed in a Nema 3 rated enclosure.

.5 Control Panel shall be capable of accepting one 120/1/60 electrical feeder.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install equipment in accordance with manufacturer’s recommendations.

.2 Install Softener package, Iron Filter package, Storage and Pressure Tanks on housekeeping pads.

.3 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

.4 Pipe blow off connections to nearest drain.

.5 Provide power and control from electrical tie in points.

.6 All piping shall be flushed prior to start-up. By-pass all equipment during flushing and cleaning.

3.2 START-UP SERVICE

.1 Manufacturer shall furnish a factory trained service technician to perform the unit start-up.

.2 Provide a start-up log by the manufacturer to document the start-up

procedure.

.3 The manufacturer shall provide instruction to the Departmental Representative and personnel on the operation and maintenance of equipment in accordance with Section 01 79 00. Manufacturer’s warranty shall include all parts and labour to install parts.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 00.

.2 All fixtures installed in the domestic water systems shall be lead free.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)
.1 ASME A112.19.2/CSA B45.1-2018, Ceramic Plumbing Fixtures (with 10/18 Errata).
.2 ASME A112.18.1/CSA B125.1–2018, Plumbing Supply Fittings (with 10/18 Errata).
.3 ASME A112.19.3/CSA B45.4–2017, Stainless Steel Plumbing Fixtures (with 5/17 & 8/17 Errata).

.2 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI)
.1 NSF/ANSI/CAN 61-2019, Drinking Water System Components – Health Effects.
.2 NSF/ANSI 372-2018, Drinking Water System Components – Lead Content.

.3 International Code Council (ICC)
.1 ICC A117.1-2017, Accessible and Usable Buildings and Facilities.

.4 Canadian Standards Association (CSA International)
.1 CAN/CSA-B651.2-07(R2017), Accessible design for self-service interactive devices.

.5 Do the work in accordance with the National Building Code of Canada 2015, National Plumbing Code of Canada 2015 and in accordance with local regulations except where specified otherwise.

.6 Do the work in accordance with Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations (SOR/2009-264) except where specified otherwise.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 22 05 00.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into maintenance manual specified in Section 22 05 00.

1.5 FIXTURES AND TRIM

.1 Architectural drawings to govern in determination of number and location of fixtures.

.2 Fixtures to be product of one manufacturer.

.3 Unless specified otherwise, trim to be product of one manufacturer.

1.6 VOC REQUIREMENTS

.1 All adhesives, sealants, paints and coatings used on or inside of building weatherproofing layer shall have a VOC content that is less than the content limits defined in SOR/2009-264.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Plumbing fixtures shall be as indicated and specified with all required supports, accessories, wastes, vent and water connections as required to make the fixture complete.

.2 Unless specified otherwise, fixtures shall be white.

.3 Unless specified otherwise, all exposed valves, pipe, escutcheon, etc., shall be polished chrome finish.

.4 Fixtures and trim shall be new and free of all defects or blemishes. Finished surfaces shall be clean, smooth, and bright guaranteed not to craze, change color or scale. Imperfections of any kind shall be sufficient reason for rejection and the item shall be removed and an acceptable replacement installed at no additional cost.

.5 Provide all lavatory hot and cold water supply lines with a renewable disc, chromium plated lock shield ball valve.

.6 Provide cast brass chrome plated escutcheon plates with set screws on all water and drain pipes where such lines pass through, floors, walls and partitions.

.7 Protect fixtures with enamel or glazed surface from damage by covering or coating as recommended in the Bulletin "Handling & Care of Enameled C.I. Plumbing Fixtures".

.8 National Building Code conforming wheel chair accessible assemblies shall be covered with an under sink/lavatory protective pipe cover.

2.2 WATER CLOSETS

.1 Water Closet Type WC-1: Floor Mounted Water Closet
.1 Floor mounted Vitreous China (454W x 767L x 820H mm) with antimicrobial surface which inhibits the growth of stain and odor causing bacteria, mold and mildew, Rim design to eliminates the rim area where dirt and buildup hide, Chrome trip lever, Dual injection flush valves, Low-consumption flush (3.8 LPF), 305mm (12”) rough-in, elongated bowl, 52mm (2-1/16”) fully glazed internal trapway, two color matched bolt caps, combination self-cleaning bowl with slow close seat. Bowl height shall be 419mm. The fixture shall

comply or exceeds the requirements of ASME A112.19.2/CSA B45.1.

.2 Water Closet Type WC-2: Floor Mounted Barrier Free Water Closet
.1 Floor mounted Vitreous China (454W x 767L x 820H mm) with antimicrobial surface which inhibits the growth of stain and odor causing bacteria, mold and mildew, Rim design to eliminates the rim area where dirt and buildup hide, Chrome trip lever, Dual injection flush valves, Low-consumption flush (3.8 LPF), 305mm (12″) rough-in, elongated bowl, 52mm (2-1/16″) fully glazed internal trapway, two color matched bolt caps, combination self-cleaning bowl with slow close seat. Bowl height shall be 419mm. The fixture shall comply or exceeds the requirements of ASME A112.19.2/CSA B45.1.

2.3 LAVATORY

.1 Basin LAV-1 – Counter Mounted with Single Lever Faucet
.1 518W x 441L x 178H mm (20-3/8″x 17-3/8" x 7″), counter mounted, vitreous china, center hole only, front overflow, faucet ledge, 32mm (1-1/4″) waste assembly, tapered edges. The fixture shall comply or exceeds the requirements of ASME A112.19.2/CSA B45.1.
.2 Single handle faucet, Polished chrome finish, Center hole only, Water conserving 4.5L/min (1.2gpm) flow rate, cast brass body, 1/4 turn washerless ceramic disc valve, brass spout, 106mm (4-3/16″) projection, Lever handle, pop-up drain, 10mm (3/8″) compression inlets, Braided flexible supply hoses, adjustable hot limit safety stop. The fixture shall comply or exceeds the requirements of ICC A117.1, ASME A112.18.1/CSA B125.1, NSF/ANSI/CAN 61/Section 9 and Annex G.
.3 Faucet Supplies shall have chrome plated finish polished brass, commercial duty 1/4 turn ball valve angel stop, 13mm (1/2″) I.D. inlet x 127mm (5″) horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers.
.4 ‘P’ Trap C.P. heavy cast brass adjustable body with slip nut, 32mm (1-1/4") with cleanout, shallow wall flange and seamless tubular wall bend.
.5 Carrier with steel pipe legs, block base feet support, concealed arms and pedestal plate. (For narrow wall installation provide ‘Z’ type sleeve for arms.) Semi-China Pedestal to cover exposed piping as per local codes.
.6 Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, Integral checks, offer temperature range between 35°C (95°F) and 46°C (114.8°F). Set valve temperature at 46°C (114.8°F)

.2 Basin LAV-2 – Barrier Free Design with Single Lever Faucet
.1 560mm x 546mm x 175mm (22"x 21-1/2" x 6-7/8″) deep, semi counter mounted fireclay china, rear overflow, recessed self-draining deck, barrier-free design, self-rimming with sealant. The fixture shall comply or exceeds the requirements of ASME A112.19.2/CSA B45.1, CAN/CSA B45, National Building Code Division B section 3.7 and CAN/CSA-B651.2 and Ontario Building Code Division B section 3.8.
.2 Single handle faucet, Polished chrome finish, Center hole only, Water conserving 4.5L/min (1.2gpm) flow rate, cast brass body, 1/4 turn washerless ceramic disc valve, brass spout, 106mm (4-3/16″) projection, Lever handle, pop-up drain, 10mm (3/8″) compression inlets, Braided flexible supply hoses, adjustable hot limit safety stop. The fixture shall comply or exceeds the requirements of ICC A117.1, ASME A112.18.1/CSA B125.1, NSF/ANSI/CAN 61/Section 9 and Annex G, IAPMD (cUPC).
.3 Faucet Supplies shall have chrome plated finish polished brass,

commercial duty 1/4 turn ball valve angel stop, 13mm (1/2") I.D. inlet x 127mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers.

.4 'P' Trap C.P. heavy cast brass adjustable body with slip nut, 32mm (1-1/4") with cleanout, shallow wall flange and seamless tubular wall bend.

.5 Carrier with steel pipe legs, block base feet support, concealed arms and pedestal plate. (For narrow wall installation provide 'Z' type sleeve for arms.) Semi-China Pedestal to cover exposed piping as per local codes.

.6 Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, Integral checks, offer temperature range between 35°C (95°F) and 46°C (114.8°F). Set valve temperature at 46°C (114.8°F).

.3 Basin LAV-3 – Barrier Free Design with No Touch Faucet

.1 560mm x 546mm x 175mm (22"x 21-1/2" x 6-7/8") deep, semi counter mounted fireclay china, rear overflow, recessed self-draining deck, barrier-free design, self-rimming with sealant. The fixture shall comply or exceeds the requirements of ASME A112.19.2/CSA B45.1, National Building Code Division B section 3.7 and CAN/CSA-B651.02 and Ontario Building Code Division B section 3.8.

.2 Electronic 'No Touch' Faucet, C.P., center hole only, die cast body, integral above deck water supply shut off, optimal mid height spout for effective hand washing, 167mm (6-9/16") projection, 1.9 l/min (0.5gpm) multi-laminar flow, braided supply hoses, active IR sensing, backup alkaline battery shall be provided along with EAF-37 transformer. The fixture shall comply or exceeds the requirements of ASME A112.18.1/CSA B125.1.

.3 Faucet supplies shall have chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13mm (1/2") I.D. inlet x 127mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers.

.4 Open grid drain, cast brass, cast brass one piece top, 1.5 mm (17 GA.) tubular 32 mm (1-1/4") tailpiece.

.5 'P' Trap, C.P heavy cast brass adjustable body, 32mm (1-1/4") with cleanout.

.6 Sanitary Covering vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

.7 Thermostatic mixing valve, solid bimetal (bronze, brass, stainless steel), Hot limit stop set to a maximum of 43°C (109.4°F). Screwdriver adjustment temperature dial with scale: COLD-HOT.

2.4 STAINLESS STEEL SINKS

.1 Kitchen Sink S-1: Double Compartment

.1 Double Bowl countertop mount sink, 521L x 794W x 152H mm (20-1/2" x 31-1/4" x6"), back ledge, grade 18-10 1.2mm (18 GA) type 304 stainless steel, satin finished rim and bowls, with spillway, self-rimming, fully undercoated to reduce condensation and resonance, with 89mm (3-1/2") crumb cup waste assembly with 38mm (1-1/2") tailpiece. The fixture shall comply or exceeds the requirements of ASME A112.19.3/CSA B45.4.

.2 Single handle faucet, stainless steel finish, center hole only, brass body, washerless ceramic disc valve cartridges, brass swing spout, 302mm (7-15/16") projection, with pressure compensating, 5.7 l/m (1.5gpm) flow aerator outlet, lever handle, pull-out spray with adjustable spray pattern,

10mm (3/8″) compression inlets, braided flexible supply hoses. The fixture shall comply or exceeds the requirements of ICC A117.1, ASME A112.18.1/CSA B125.1, NSF/ANSI/CAN 61/Section 9 and NSF/ANSI 372.

.3 Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, Integral checks, offer temperature range between 35°C (95°F) and 46°C (114.8°F). Set valve temperature at 46°C (114.8°F).

.4 Faucet Supplies, Chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, Escutcheon and flexible copper risers.

.5 P-Trap, Chrome plated finish, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, With cleanout, Box flange and Seamless tubular wall bend.

.6 Sanitary Covering vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

2.5 SHOWERS

.1 Shower SH-1: Individual Control Pressure Balancing Valve

.1 Complete shower system kit includes: a shower head, polished chrome finish. 5.7 l/m (1.5gpm) maximum flow rate, pressure compensating flow control device, 48mm (1-7/8″) face dia, single function turbine drenching spray pattern; a wall mount shower arm, Polished chrome finish with brass construction, 140mm (5-1/2″) long with 45degree angle, round escutcheon; and a pressure balancing shower valve trim, polished chrome finish, 191mm (7-1/2″) round shaped trim face plate, on/off, volume and temperature control single lever handle. The fixture shall comply or exceeds the requirements of ASME A112.18.1/CSA 125.1.

.2 Pressure Balance Shower Rough Valve, Cast brass body, Ceramic disc valve cartridges, Integral hot water limit stop, Screw driver stops,13 mm (1/2") universal inlet(s)/outlet(s), Back-to-back capability.

.3 Floor Drain epoxy coated cast iron, 127 mm (5") adjustable round nickel bronze strainer, floor drain, reversible clamping collar with primary & secondary weepholes.

.4 P-Trap, Same material as the connecting pipe drain.

2.6 LAUNDRY TUB & GARAGE WASH-UP SINK

.1 LT-1: Laundry Tub

.1 Twin compartment laundry tub, furnished with and supported by two mounting brackets of heavy gauge galvanized steel capable of being secured to the wall with mechanical fasteners. Side fillers, are made of white molded plastic polymer.

.2 Outside Dimensions: 1016 mm (40") wide x 610 mm (24") long x 352 mm (13-7/8") high.

.3 Two handles center set laundry sink faucet, durable brass construction with brass inlet shanks and coupling nuts, 1/4 turn washerless ceramic disc valve cartridges, 12.7mm (One-half inch) male inlet shanks with brass coupling nuts, Brass swivel spout (360° rotation) with hose end with 8.3 l/min(2.2 gpm) maximum flow rate. Meets NSF/ANSI/CAN Standard 61/Section 9 & Prop 65 lead requirements. The fixture shall comply or exceeds the requirements of ICC A117.1, ASME A112.18.1/CSA B125.1, NSF/ANSI/CAN 61/Section 9.

2.7 EYEWASH

.1 Eyewash: Portable Gravity Fed
.1 Portable gravity operated eyewash shall include a FDA approved high-density polyethylene 34.1 L (9 gallon) tank, ABS plastic eyewash heads with 1.5Lpm (0.4 gpm) flow rate over 15minutes, pull down activation arm, integral handle with “lift here” graphics on top, clearly visible fill line, wide-fill threaded cap, sign-mounted operating instruction and stainless steel wall bracket.

2.8 WASH BOX

.1 Wash box - WB-1: For Clothes Washers
.1 Flush with wall, with single lever operated valve, hose end outlets, copper liner, service stops, 12.7mm (½"), hot and cold water connection, 38mm (1 ½") drain outlet. “p” trap cast brass, 38mm (1 ½") concealed in wall.

PART 3 - EXECUTION

3.1 FIXTURE INSTALLATION

.1 Connect fixtures complete with supplies and drains, traps and cleanouts, supported level and square. Hot water faucets shall be on left.

.2 Provide venting for all plumbing fixtures as required by codes.

.3 All handicap fixtures to be mounted at heights to be in accordance with National Building Code requirements and shall be in accordance with requirements of local authorities having jurisdiction.

.4 Provide chrome plated flexible supplies to fixtures with screw driver stops, reducers and escutcheons.

.5 All piping shall be recessed unless otherwise approved. Piping to be installed in areas shall be run in neat parallel lines as tight as possible to walls and ceilings.

.6 Mechanical Division shall provide all wiring for the electronic lavatories from the connections within the room provided by Electrical Division to the lavatories.

.7 Install eyewash unit in accordance with manufacturer’s recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation for plumbing specialties and accessories.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
  .1 CSA B64 Series-11(R2021), Backflow Preventers and Vacuum Breakers.
  .2 CAN/CSA-B356-10(R2020), Water pressure reducing valves for domestic water supply systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015)
  .1 Safety Data Sheets (SDS).

.3 Plumbing and Drainage Institute (PDI)
  .1 PDI-WH201-2017, Water Hammer Arresters.

.4 National Plumbing Code of Canada 2015

.5 American National Standards Institute (ANSI)/NSF International
  .1 NSF/ANSI/CAN 61-2020 – Drinking Water System Components - Health Effects.

.6 ASTM International
  .1 ASTM A536-84(2019)e1 – Standard Specification for Ductile Iron Castings.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
  .2 Indicate dimensions, construction details and materials for specified items.

PART 2 - PRODUCTS

2.1 CLEANOUTS

.1 Line Cleanouts
  .1 Line cleanouts in cast iron pipe with polyurethane gasketted cover secured to body with full size pipe opening.

.2 Stack Cleanout
  .1 In base of cast iron stacks with neoprene gasketted secured cover. Where cleanouts are concealed behind finished walls access shall be round stainless steel plate and slotted flat head S.S. screws.

.3 Floor Cleanouts
.1 Body (For all cleanouts):
.1 Epoxy coated cast body with integral clamp device, and removable positive seal cleanout plug

.4 In Unfinished Areas.
.1 Heavy duty 150 mm (6") adjustable cover secured with stainless steel screws.

.5 In Finished Areas
.1 All cleanouts shall be coordinated with the Architectural floor finish. Submit shop drawing showing all floor cleanouts on Architectural Terrazzo Finish Drawing to coordinate location with Architectural Terrazzo prior to installation.

.6 In tiled areas:
.1 Square nickel bronze cover secured with stainless steel screws and frame recessed for tile. Cover shall be adjustable to suit floor lines when installing finished floor.

.7 In carpeted areas:
.1 Nickel bronze cover and frame secured with stainless steel screws. Cover shall be adjustable to suit floor lines when installing finished floor.

.8 In other finished areas:
.1 Nickel bronze frame and cover secured with stainless steel screws. Cover shall be adjustable to suit floor lines when installing finished floor.

.9 In heavy traffic areas
.1 Extra heavy nickel bronze frame and cover secured with stainless steel screws. Cover shall be adjustable to suit floor lines when installing finished floor.

2.2 WATER HAMMER ARRESTORS

.1 Copper construction, bellows piston type: to PDI-WH201.

2.3 BACK FLOW PREVENTERS

.1 Preventers: to CSA B64 Series, reduced pressure principle type double check valve assembly back flow preventer with intermediate atmospheric vent or vacuum breaker.

2.4 VACUUM BREAKERS

.1 Breakers: to CSA B64 Series, vacuum breaker atmospheric hose connection laboratory faucet intermediate.

2.5 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventer pressure gauge on inlet and outlet, pressure reducing valve to CAN/CSA-B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

2.6 INTERCEPTORS

.1 OIL INTERCEPTOR – “OI-01”

.1 Epoxy coated steel interceptor, epoxy coated non-slip heavy duty cover secured with hex head center bolts and required extension to suite the site installation, double wall deep seal trap, draw-off connection and dual vent connections, integral stainless steel flow control plate, and no hub connections.
.2 The interceptor shall be suitable for underground installation.
.3 Interceptors shall be designed to minimize turbulence, promote centrifugal separation and settling and prevent resuspension and scouring of collected materials. Temporary backwater conditions shall not cause trapped contaminants to be resuspended or scoured from the interceptor.
.4 Provide a cleanout, sample and ventilation ports together with an extension collar and frame and cover to allow access for removal of oil, grease and solids.
.5 The interceptor shall be designed to remove from process wastewater free oil, grease and other floatable materials.
.6 The interceptor shall have the have the following minimum capacity.

Flow Rate	Body Dimensions	Inlet & Outlet Dimensions
190 lpm (50 gpm)	857mm (33-3/4”) L x 527mm (20-3/4”) W x 546mm (21-1/2”) H	102 mm (4”)

2.7 NON FREEZE WALL HYDRANT

.1 Non Freeze Wall Hydrant “NFWH-1”:
.1 Encased recessed non freeze wall or ground hydrant with NPS 20 mm (3/4") hose outlet with integral backflow preventer and vacuum breaker. Removable operating key. 1/4 turn non-drip, ceramic cartridge, with bronze face and stainless steel with full 180 degree cover opening box, adjustable wall flange operating key and self draining integral vacuum breaker. Provide adjustable wall flange to provide a secure installation. Length to suit wall thickness.

2.8 FLOOR DRAINS

.1 FLOOR DRAINS - WITH COMBINATION FUNNEL “FFD-1”:
.1 All epoxy coated cast iron body with seepage flange, adjustable collar, clamping device and 203mm (8") grate with full opening in grate for 102mm x 229mm (4" x 9") oval funnel.

.2 Floor Drains - Mech. Rooms/Unfinished Areas “FD-2”:
.1 All epoxy coated cast iron body with seepage flange, adjustable collar, clamping device and 203mm (8")diameter grate.

.3 Floor Drains - Showers “FD-3”:
.1 All epoxy coated cast iron body with reversible clamp device and adjustable 127 mm (5") diameter nickel bronze 3.2 mm (1/8") thick strainer, secured with stainless steel screws, 100 mm (4") throat on strainer. In quarry or mosaic tiled areas provide square - 152 mm x 152 mm (6" x 6") nickel bronze 3.2 mm (1/8") thick square strainer.

2.9 HUB DRAINS

.1 Hub Drains – Membrane Areas - Non Corrosive Environments “HD-1”:
.1 All epoxy coated cast iron body with reversible clamp device and adjustable 102 mm (4") diameter full open throat hub.

2.10 TRENCH DRAIN

.1 TRENCH DRAIN “TD-1”:

.1 Precast polymer concrete 150 mm (6") wide x 1 m (39.4”) long, sloped modular system with interlocking components, integral galvanized steel rail and heavy duty Class ‘E’ slotted resin composite grates and anchor ribs on the outside of the channel wall. Inside dimension of trench to be 100mm (4"). Provide minimum 102mm (4”) or same as slab thickness bedding of concrete all around trench. Provide channel end caps as required. Provide sufficient lengths to meet the length indicated on the drawings.

.2 Trench to be connected via positive interlocking tongue and groove ends. Length to be as shown on the drawings.

.3 Built in channel slope to be 0.6% complete with radiused bottom.

.4 Provide removable trash bucket within catchbasin. Material of trash bucket to be suitable for mildly acidic and caustic environments.

2.12 HOSE BIBBS

.1 Cold Water Only “HB-1”:

.1 Cold water only, 12 mm (1/2") size wall type rough bronze with hose end vacuum breaker.

2.13 TRAP SEAL PRIMERS

.1 Provide for all floor and hub drains.

.2 All Locations

.1 The unit shall supply a minimum of 0.3L (10 oz.) Of water per opening, once in each 24 hour period based on system pressure of 414kP (60 psi). Factory assembled with a bronze body ball valve, water hammer arrester, solenoid valve, atmospheric vacuum breaker, 24 hour timer, 20mm (3/4") NPT connection, and a type L copper manifold. Electronic single point power connection 120 V 1 amp draw and manual override switch

.2 Trap primer shall be mounted 305mm (1ft) above the floor for every 6.1m (20ft) of make-up water line.

2.15 STRAINERS

.1 All strainers to be 860 kPa (125 psi) gauge pressure Y type strainer with 20 mesh (3/4"), bronze or stainless steel removable screen.

.1 50 mm (2") nominal and under:

.1 Bronze, and screwed with brass cap.

.2 65 mm (2 1/2") nominal and over:

.1 Cast iron, flanged with bolted cap.

.2 All strainers on plumbing systems shall be NSF certified to NSF/ANSI/CAN 61. All strainers to be 860 kPa (125 psi) gauge pressure Y type strainer with 20 mesh (3/4"), stainless steel removable screen.

.3 Strainers located in the incoming Domestic Cold Water feed to the building shall be provided with pressure gauge taps on the inlet and the discharge of the strainer and a single pressure gauge shall be piped across the strainer for differential pressure measurement.

2.16 TRAPS

.1 Cast iron body deep seal traps, threaded, hub, or spigot on inlet.

.1 PLENUM DRAIN - "PD-1"

.1 Stainless steel strainer basket with rubber gasket seal and coupling nut, 38 x102mm (1-1/2" x 4").

2.17 PRESSURE REGULATING CONTROL VALVE

.1 Pressure regulating control valve shall be of the type that maintain a constant lower downstream pressure due a fluctuating upstream pressure regardless of varying flow rates.

.2 The regulating valve shall be controlled by a normally open pressure reducing pilot designed to open when the downstream pressure is below the adjustable set point and close when the downstream pressure is above the adjustable set point. A decrease in downstream pressure shall cause the pressure regulating valve to modulate open to increase the downstream pressure. An increase in downstream pressure shall cause the pressure regulating valve to modulate close to decrease the downstream pressure.

.3 The pressure regulating valve shall be suitable for installations on PVC and Stainless steel piping systems.

.4 The pressure regulating valve shall be of the following construction
- .1 Body and Cover: Ductile Iron ASTM A536
- .2 Coating: NSF/ANSI/CAN 61 listed fusion bonded epoxy lined and coated
- .3 Trim: 316 Stainless Steel
- .4 Elastomers: Viton
- .5 Stem, Nut and Spring: Stainless Steel

.5 The pressure regulating valve shall be capable of withstanding an operating pressure of 1.7MPa (250 psi) at a maximum temperature of 121 °C (250°F). The pilot system of the valve shall be capable of operating in a pressure range of 0.14 to 1.2MPa (20 to 175 psi).

.6 Provide pressure gauges on the inlet and outlet of the valve to monitor upstream and downstream pressure.

2.18 DUAL CHECK VALVES

.1 Provide dual check valves in the locations shown on the drawings.

.2 The dual check backflow preventer shall meet the domestic requirements of CSA B64.10 and bear the seal of approval.

.3 It shall be bronze-bodied and include not less than one union, with the union nut drilled to accept a tamper-proofing lock wire. A brass identification tag indicating direction of flow shall be securely attached to the valve body by corrosion-resistant mechanical fasteners.

.4 Temperature Range: 0.5°C-82°C (33°F – 180°F) continuous.

.5 Maximum Working Pressure: 10.3 bar (150psi).

2.19 BACKWATER VALVES

.1 Epoxy coated cast iron body, bolted access cover with gasket, with bronze seat and revolving double fulcrum flapper, and stainless steel pin.

2.20 THERMAL EXPANSION TANK FOR DHW SYSTEMS

.1 Bladder type expansion tank suitable for thermal expansion in Domestic Hot Water System. The Domestic Hot Water shall not come into contact with the steel tank.

.2 Capacity: As indicated on drawings.

.3 Tanks shall be welded steel construction, ASME Section VIII, Division 1 suitable for a working pressure of 1033.5 kPa (150 psig) and a temperature of 115˚C (240˚F).

.4 Air shall be pre-charged at 275.6 kPa (40 psig). Tank shall be complete with an air charging valve.

.5 Bladder shall be made of heavy duty Butyl Bladder.

.6 All internal parts shall comply with the requirements of ANSI/NSF 61, FDA, Canadian Water Quality Association and Health Canada requirements.

.7 Tanks shall be supported by steel legs or base for floor installations and shall be supported by adequate straps and hangers for ceiling installations.

2.21 HYDRO-PNEUMATIC TANKS FOR COLD WATER BOOSTER SYSTEMS

.1 Bladder type tank for Hydro-pneumatic applications for Cold Water Booster system. The Domestic Cold Water shall not come into contact with the steel tank.

.2 Capacity: As indicated on drawings.

.3 Tanks shall be welded steel construction, ASME Section VIII, Division 1 suitable for a working pressure upto 1722.5 kPa (250 psig) and a temperature of 115˚C (240˚F).

.4 Air shall be pre-charged at 275.6 kPa (40 psig). Tank shall be complete with an air charging valve.

.5 Bladder shall be made of heavy duty Butyl Bladder.

.6 All internal parts shall comply with the requirements of ANSI/NSF 61, FDA, Canadian Water Quality Association and Health Canada requirements.

.7 Tanks shall be supported by steel legs or base for floor installations and shall be supported by adequate straps and hangers for ceiling installations.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or

specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required by code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.5 BACK FLOW PREVENTORS

.1 Install in accordance with CSA B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain and or service sink.

3.6 WATER MAKE-UP ASSEMBLY

.1 Install on valved bypass.

.2 Pipe discharge from relief valve to nearest floor drain.

3.7 OIL INTERCEPTOR BURIED

.1 The oil interceptor shall be installed level with a 150mm (6") layer of pea gravel or approved equivalent backfill compacted to 98% proctor density beneath the interceptor.

.2 Backfill up to the inlet and outlet pipes with pea gravel or approved equivalent backfill in 150mm (6") layers. The backfill shall be compacted to 98% proctor density.

.3 When the inlet and outlet connections points are reached install inlet and outlet pipes.

.4 Install the extension collar, the cleanout and sample pipes.

.5 Backfill with coarse sand, gravel, pea gravel or approved equivalent around the extension collar to the concrete bearing slab. The backfill shall be compacted to 98% proctor density.

.6 Install the frame and cover. Install all required clean out caps.

.7 Activate, using manufacturer's recommended procedures and materials.

3.8 HOSE BIBBS

.1 Install at bottom of all risers, at low points to drain systems, and as indicated.

3.9 TRAP SEAL PRIMERS

.1 Install on cold water supply to nearest plumbing fixture, in concealed space and in accordance with manufacturers recommendations.

.2 Install shut off valves, solenoid valves and timer in accordance with manufacturer's instructions. Provide wiring and connections as required. Mechanical contractor shall be responsible for all electrical wiring to the timer from the nearest junction box and circuit provided by Electrical Contractor and all control wiring from the timer to the solenoid valves. The electrical work carried out shall comply with Electrical Division.

.3 The trap seal primers are not shown on the drawing. The Mechanical Contractor shall be responsible for locating the trap seal primers in Janitor’s closets, Storage Rooms or Mechanical rooms and providing all piping and wiring from these locations.

3.10 STRAINERS

.1 Install in accordance with manufacturers' instructions. Allow sufficient room to remove basket.

3.11 FLOOR DRAINS

.1 Install all square floor drains perpendicular to walls and in accordance with manufacturer’s recommendations.

3.12 PRESSURE REDUCING CONTROL VALVE

.1 Flush all debris form the piping system. Install valves horizontally “in line” so that the flow arrows match the direction of flow in the piping system. (Do not install valves in the vertical position)

.2 Ensure that isolation valves upstream and downstream of the pressure control valve do not contact the valve.

.3 Provide pressure gauges on the inlet and outlet of the valve to monitor upstream and downstream pressure.

.4 Provide a pressure relief valve downstream of the pressure control valve if very low flow conditions less than 20% of continuous flow, are expected to be encountered.

.5 Follow manufacturer’s instruction for start-up.

3.13 TESTING AND ADJUSTING

.1 Testing and Adjusting as per following:
  .1 Timing:
    .1 After start-up deficiencies rectified.
    .2 Floor drains:

.1 Verify operation of trap seal primer.
.2 Prime, using trap primer. Adjust flow rate to suit site conditions.
.3 Check operations of flushing features.
.4 Check security, accessibility, removeability of strainer.
.5 Clean out baskets.

.3 Vacuum breakers, backflow preventers:
.1 Test tightness, accessibility for O&M of cover and of valve.
.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
.3 Verify visibility of discharge from open ports.

.4 Access doors:
.1 Verify size and location relative to items to be accessed.

.5 Cleanouts:
.1 Verify covers are gas-tight, secure, yet readily removable.

.6 Water hammer arrestors:
.1 Verify proper installation of correct type of water hammer arrester.

.7 Pressure regulators, PRV assemblies:
.1 Adjust settings to suit locations, flow rates, pressure conditions.

END OF SECTION

PART 1 - GENERAL

1.1 USE OF SYSTEMS

.1 Use of new and or existing permanent heating and or ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions:
.1 Entire system is complete, pressure tested, cleaned, flushed out.
.2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
.3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
.4 There is no possibility of damage from any cause.
.5 Supply ventilation systems are protected by 60% filters, which shall be inspected daily, changed every week 2 weeks or more frequently as required.
.6 Return systems have approved filters over all openings, inlets, outlets.
.7 All systems will be:
.1 operated as per manufacturer's recommendations or instructions.
.2 operated by Contractor.
.3 monitored continuously by Contractor.
.8 Warranties and guarantees are not thereby relaxed.
.9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Departmental Representative.
.10 Before static completion, entire system to be refurbished, cleaned internally and externally, restored to "as- new" condition, filters in air systems replaced.

.2 Filters referred to herein are over and above those specified elsewhere in this specification.

.3 Exhaust systems are not included in any approvals for temporary heating ventilation.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 EQUIPMENT LIST

.1 Complete list of equipment and materials to be used on this project and forming part of bid documents number and details of materials, and submit for approval.

.2 Submit for approval within 10 days after Award of Contract.

1.2 TRIAL USAGE

.1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.3 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.4 PAINTING

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.5 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Where specified elsewhere in Mechanical Divisions, manufacturers to provide demonstrations and instructions.

.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Where deemed necessary, Departmental Representative may record these demonstrations on video tape for future reference.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Departmental Representative before final inspection.

.3 Operation data to include:
.1 Control schematics for each system including environmental controls.
.2 Description of each system and its controls.
.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for each system and each component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.7 Colour coding chart.

.4 Maintenance data shall include:
.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:
.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
.2 Equipment performance verification test results.
.3 Special performance data as specified elsewhere.
.4 Testing, adjusting and balancing reports as specified in Section 23 05 93.

.6 Approvals:
.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.
.2 Make changes as required and re-submit as directed by Departmental Representative.

.7 Additional data:
.1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.7 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Shop drawings and product data shall show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances. eg. access door swing spaces.

.3 Shop drawings and product data shall be accompanied by:
.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify as to current model production.
.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.8 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

1.9 AS-BUILT DRAWINGS

.1 Site records:
.1 Departmental Representative will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark there on all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
.3 Mark up PDF drawings showing work as actually installed. Use a different colour for each service.
.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings:
.1 Submit in accordance with Section 01 78 00.
.2 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
.3 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
.4 Submit to Departmental Representative for approval and make corrections as directed.
.5 TAB to be performed using as-built drawings.
.6 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
.7 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.3 Submit copies of as-built drawings for inclusion in final TAB report.

.4 As-built drawings for inclusion in final TAB report.

.5 As-built drawings shall be all converted to AutoCAD according to PWGSC standards.

.6 Submit as-built AutoCAD and PDF in Flash Drive. Allow for minimum two (2) sets.

.7 All TAB reports shall be in PDF format and copied to Flash Drive and folder prints.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.11 EXAM SITE

.1 Examine the site and the local conditions and Conditions affecting the work during tender process. Examine carefully the Architectural, Structural, and Mechanical, Electrical and all other drawings and the complete specifications to ensure that the work can be satisfactorily carried out as shown.

.2 Before commencing work, examine the work of the other Divisions and report at once any defect or interference affecting the work, the completion, or the guarantee of the work of this Division. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Departmental Representative.

1.12 CODES, PERMITS FEES AND CONNECTIONS

.1 Conform to Federal, Provincial and Municipal regulations and perform work in accordance with requirements of By Laws and Regulations in force in area where the building is to be erected.

.2 Apply for, obtain, and pay for permits, fees and service connections for the work of this Division and the inspections required by Authorities having jurisdiction in the area where the building is to be erected.

.3 For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.

.4 When part of equipment does not bear the required UL label, the Contractor shall obtain UL approval on site, when that part of the equipment is an electric component, a special approval shall be obtained and the Contractor shall pay the applicable fees.

.5 Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.

.6 Apply to TSSA for high pressure application. Ensure all systems are tested to TSSA satisfaction.

1.13 INSTALLATION OF WORK

.1 Coordinate with other trades and schedule all work to suit the date for the substantial performance established in the construction contract.

.2 Furnish items to be "built up" in ample time and give necessary information and assistance in connection with the building in of the same.

.3 Provide drawings showing all sleeving and openings required. Notify the Departmental Representative of the size and location of recesses, openings and chases before walls, floors, etc., are erected.

.4 Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the building schedule. Ensure that all health, safety and environmental conditions are maintained.

.5 Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Departmental Representative within the time limit stipulated.

.6 Furnish promptly information required for the construction schedule.

.7 Manufactured products supplied with instructions for their installation shall be installed in strict accordance with those instructions.

1.14 WORK IN EXISTING BUILDINGS

.1 Do not disturb any hydraulic piping without through examination to ensure it is safe and empty. Ensure isolating valves are operational prior to carrying out any work.

.2 Freeze lines if required to make required connections.

1.15 SLEEVES

.1 Use cast iron sleeve or steel pipe sleeves with annular fin continuously welded at midpoint.

.2 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water tight durable joint.

.3 Fill voids around pipes

.1 For sleeves and pipe in foundation walls and below grade floors, provide "link seal" clamp.

.2 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe (duct) and sleeve with waterproof fire retardant non hardening mastic. Seal space at each end of sleeve with waterproof, fire retardant, non-hardening mastic.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future use sleeves with easily removable fire stop filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

.4 All sleeves shall be as detailed on drawings.

.5 All sleeve locations including dimensions shall be submitted to the Departmental Representative.

1.16 TESTS

.1 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.2 Inform the Departmental Representative when tests will be conducted. All tests are to be documented test results submitted and included in the maintenance manuals.

.3 Bear costs including retesting and making good.

.4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.17 SUMMARY OF COMMISSIONING

.1 Commissioning (Cx) is a systematic quality process of ensuring that building systems perform and interact according to the Departmental Representative's and the Design Engineers' Project Requirements and contract documents.

.2 Desired Outcomes

.1 A commissioned building provided optimized energy and occupant comfort, and sets the stage for minimal operation and maintenance costs. It serves as a tool for both the Departmental Representative and the Contractor to minimize post-occupancy remedial work.

.3 Commissioning Goals

.1 The Commissioning Process for a project typically focuses on systems and assemblies having to do with the performance objectives meeting the Departmental Representative 's Project Requirements (OPR). Contractors, associated Sub-Contractors, equipment and material Suppliers are to support and ensure the requirements for commissioning are met in their respective work.

1.18 DEFINITIONS

.1 Departmental Representative’s Project Requirements (OPR)

.1 The documentation of the functional performance requirements of the facility and the Departmental Representative 's expectations of how it will be used and operated. This document is analogous to what has traditionally been referred to as the Departmental Representative Program.

.2 Basis of Design (BOD)

.1 A project-specific set of assumptions and design parameters for system and product selections to meet the OPR and applicable regulatory requirements.

.3 Commissioning Agent (CxA)

.1 Third party hired by the contractor, not otherwise associated with the Architectural and Engineering Teams. The CxA facilitates and coordinates the commissioning activities. Involvement of CxA shall not void any guarantees or warranties nor shall it relieve the Contractor of any contractual responsibilities.

.4 Deficiency/Issue

.1 A condition in the installation or function of a component or system

that is not in compliance with the construction contract documents and/or Departmental Representative's requirements.

.5 Start-up/Pre-Functional The initial starting or activating of dynamic equipment, including the checkout of components and devices and completing static installation checklists.

.6 Functional Performance Testing (FPT)

.1 Testing performed by the Construction Team to verify that specific components, assemblies, systems, and integrated systems function and perform in accordance with the Departmental Representative's objectives and the contract documents. Tests are generally performed after the Contractor's start-up and initial checkouts are completed.

1.19 COMMISSIONING PLAN

.1 The CxA will develop a Commissioning Plan unique to the project.

.2 The Commissioning Plan identifies the strategies, aspects, and responsibilities within the commissioning process for all project team members.

.3 The Commissioning Plan contains the following information:

.1 Commissioning Program Overview

.1 Goals and objectives

.2 General project information

.3 Systems to be commissioned.

.2 Commissioning Team

.1 Team members, roles, and responsibilities.

.2 Communication protocol, coordination, meetings, and management.

.3 Commissioning Process Activities

.1 Documenting the Departmental Representative's project requirements.

.2 Preparing the basis of design.

.3 Developing systems functional performance test procedures.

.4 Verifying systems performance.

.5 Reporting deficiencies and the resolution process.

.4 List of systems and assemblies to be commissioned.

.5 The Contractor and the Sub-Contractors shall carryout commissioning activities as per the Commissioning Plan.

1.20 COMMISSIONING DOCUMENTATION

.1 The Commissioning Process includes a significant documentation and paper component. Commissioning documents include but are not limited to:

.1 Drawings and Specifications.

.2 Shop Drawings.

.3 Pre-Functional Check Sheets.

.4 OEM/Contractor Start Up/Test Forms and Records.

.5 As Built Drawings.

.6 Functional Performance Test Plans and Results.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

.1 Cutting and patching shall be in accordance with the following:

.1 No openings shall be permitted through the completed structure without the written approval of the Departmental Representative. Any openings which are required through structure must be clearly and accurately shown. Exact locations, elevations and size of the proposed opening must be identified and submitted to the Departmental Representative for review, well in advance of doing the work.

.2 All cutting and patching shall be done by the trades specializing in the materials to be cut and is covered by the appropriate Divisions of this specification. Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure and all insert sizes and locations.

.3 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Departmental Representative in writing.

.4 Scan and x-ray floors prior to carrying out any openings. Rebars shall not be cut.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 Green Seal Environmental Standards (GSES)
  .1 GSES GS-11-2015, Paints, Coatings, Stains, And Sealers.
  .2 GSES GS-36-2013, Adhesives For Commercial Use.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Paint: zinc-rich to CAN/CGSB-1.181.
  .1 Paint in accordance with manufacturer's recommendations for surface conditions.
  .2 Primer: maximum VOC limit 250 g/L to GSES GS-11
  .3 Paints: maximum VOC limit 150 g/L to GSES GS-11.

.2 Sealants: in accordance with Section 07 92 00.
  .1 Sealants: maximum VOC limit to GSES GS-36.

.3 Adhesives: maximum VOC limit to GSES GS-36.

.4 Fire Stopping: in accordance with Section 07 84 00.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: NPS 3/4 ball valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

.1 Install manual air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.6 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.8 Install, except where indicated, to permit separate thermal insulation of each pipe.

.9 Group piping wherever possible and as indicated.

.10 Ream pipes, remove scale and other foreign material before assembly.

.11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.12 Provide for thermal expansion as indicated.

.13 Valves:
.1 Install in accessible locations.
.2 Remove interior parts before soldering.
.3 Install with stems above horizontal position unless otherwise indicated.
.4 Valves accessible for maintenance without removing adjacent piping.
.5 Install globe valves in bypass around air handling unit control valves.
.6 Use ball or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
.7 Install butterfly valves on chilled water only.
.8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
.9 Install plug cocks or ball valves for glycol service.
.10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.14 Check Valves:
.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.8 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:
.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
.2 Other floors: terminate 25 mm above finished floor.
.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:
.1 Foundation walls and below grade floors:
.1 fire retardant, waterproof non-hardening mastic.
.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
.3 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: one piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

.1 Fill system with water, ensure air is vented from system.

.2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa.

.3 Use water metre to record volume of water in system to +/- 0.5%.

.4 Add chemicals under direct supervision of chemical treatment supplier.

.5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test

concentrations and adjust to recommended levels.

.6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.

.7 Add chemical solution to system.

.8 Establish circulation, raise temperature slowly to the maximum design temperature. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite.

.9 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 supplemented as specified in relevant mechanical sections.

.10 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.13 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Departmental Representative.

.2 Request written approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

3.14 CLEANING

.1 Clean in accordance with Section 01 74 00.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
.1 ANSI/ASHRAE 90.1-2019, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI/ASHRAE/IES).

.2 Electrical Equipment Manufacturers' Advisory Council (EEMAC).

.3 IEEE 841-2018, IEEE Draft Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors-Up to and Including 370 kW (500 hp).

1.2 SECTIONS INCLUDES

.1 Electrical work to conform to Electrical Divisions including the following:
.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 33 00.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Motors to be high efficiency, in accordance with local Hydro company standards and the requirements of ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Replace motor for existing return fan, as indicated on the drawings.

.3 If delivery of specified motor will delay delivery or installation of equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.4 Motors under 373 W (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.5 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C, 3-phase, 600 V, unless otherwise specified or indicated.

.6 All motors shall be 1750 rpm unless otherwise noted.

.7 All motors shall be high efficiency, suitable for full voltage starting, rated for the voltage indicated in the schedule and shall have a service factor of 1.15. For the VFD applications motors shall be inverter duty, rated for service factor of 1.25.

.8 All motors shall have minimum NEMA Class F insulation systems or be rated for VFD application (when applicable). All motors shall be capable of supplying nameplate and service factor horsepower ratings on a continuous basis without exceeding the 105°C temperature rise in a 40°C ambient temperature.

.9 The temperature rises described above are based upon measurements by the resistance method. These limits shall not be exceeded when the voltage and frequency applied to motors are within the limitations of NEMA MG1.

.10 All motors shall have copper stator windings and motor leads.

.11 Aluminum die-cast rotor assemblies shall be provided, if available.

.12 Where aluminum die-cast rotor assemblies are not provided, rotor bars and conducting end rings shall be made of copper or copper alloys, with the bars welded or brazed to the rings. No phosphorous brazing materials may be used.

.13 Motors 3 HP and above shall be constructed to IEEE 841 standards and shall carry IEEE 841 certifications. Motors without IEEE 841 certifications and labeling shall be replaced by the contractor at their costs.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10) HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave to be determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm dia holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:
- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:
- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
.1 ASME B40.100-2013, Pressure Gauges and Gauge Attachments.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
.2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

.2 Ranges: as indicated.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to CAN/CGSB-14.4.
.1 Resistance to shock and vibration.

2.3 REMOTE READING THERMOMETERS

.1 100 mm diameter mercury-free liquid filled vapour activated dial type: to CAN/CGSB-14.5, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished brass or stainless steel case for wall mounting.

2.4 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.5 PRESSURE GAUGES

.1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:
- .1 Snubber for pulsating operation.
- .2 Gasketted pressure relief back with solid front.
- .3 Bronze stop cock.
- .4 Oil filled for high vibration applications.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.
- .1 If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:
- .1 Heat exchangers.
- .2 Where indicated on schematics.

.3 Install wells as indicated only for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations as follows:
  .1 Upstream and downstream of PRV's.
  .2 In other locations as indicated on schematics.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES

.1 Install engraved lamicoid nameplates in accordance with Section 23 05 53, identifying medium.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
- .1 ASME B1.20.1-2013(R2018), Pipe Threads, General Purpose (Inch).
- .2 ASME B16.18-2018, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International
- .1 ASTM A276/276M-17, Standard Specification for Stainless Steel Bars and Shapes.
- .2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 ASTM B283/B283M-19a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
- .4 ASTM B505/B505M-18, Standard Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
- .1 MSS SP-80-2013, Bronze Gate Globe, Angle and Check Valves.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
- .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit WHMIS 2015 SDS - Safety Data Sheets.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:
- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Valves:
- .1 Except for specialty valves, to be single manufacturer.
- .2 Products to have CRN registration numbers.

.2 End Connections:
- .1 Connection into adjacent piping/tubing:
  - .1 Steel pipe systems: screwed ends to ASME B1.20.1.
  - .2 Copper tube systems: solder ends grooved ends to ASME B16.18.

.3 Gate Valves:
- .1 Requirements common to gate valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: union with hexagonal shoulders.
  - .3 Connections: screwed with hexagonal shoulders.
  - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
  - .5 Packing: non-asbestos.
  - .6 Handwheel: non-ferrous.
  - .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 12.5
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: Handwheel.
- .3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: handwheel.
- .4 NPS 2 and under, rising stem, split wedge disc, Class 125:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Disc: split wedge, bronze to ASTM B283/B283M, loosely secured to stem.
  - .3 Operator: handwheel lockshield.
- .5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Operator: handwheel.
- .6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
  - .1 Body: with long disc guides, screwed union bonnet.
  - .2 Operator: handwheel.

.4 Globe Valves:
- .1 Requirements common to globe valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: union with hexagonal shoulders.
  - .3 Connections: screwed with hexagonal shoulders.
  - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
  - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
  - .6 Handwheel: non-ferrous.
  - .7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, composition disc, Class 125:
.1 Body and bonnet: screwed bonnet.
.2 Disc and seat: renewable rotating PTFE disccomposition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505/B505M.
.3 Operator: handwheel lockshield.
.3 NPS 2 and under, composition disc, Class 150:
.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505/B505M.
.3 Operator: handwheel lockshield.
.4 NPS 2 and under, plug disc, Class 150, screwed ends:
.1 Body and bonnet: union bonnet.
.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276/276M, loosely secured to stem.
.3 Operator: handwheel.
.5 Angle valve, NPS 2 and under, composition disc, Class 150:
.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
.3 Operator: handwheel lockshield.

.5 Check Valves:
.1 Requirements common to check valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Connections: screwed with hexagonal shoulders.
.2 NPS 2 and under, swing type, bronze disc, Class 125:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
.3 NPS 2 and under, swing type, bronze disc:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
.4 NPS 2 and under, swing type, composition disc, Class 200:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.
.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
.2 Disc: renewable PTFE no. 6 composition rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.
.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.6 Silent Check Valves:
.1 NPS 2 and under:
.1 Body: cast high tensile bronze to ASTM B62 with integral seat.
.2 Pressure rating: Class 125.
.3 Connections: screwed ends to ASME B1.20.1 and with hex. shoulders.
.4 Disc and seat: renewable rotating disc.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

.7 Ball Valves:
.1 NPS 2 and under:
.1 Body and cap: cast high tensile bronze to ASTM B62.
.2 Pressure rating: Class 125 2760-kPa CWP 4140-kPa CWP, 860 kPa steam.
.3 Connections: screwed ends to ASME B1.20.1 and with hexagonal shoulders solder ends to ANSI.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable stainless steel hard chrome solid ball and Teflon seats.
.7 Stem seal: TFE with external packing nut.
.8 Operator: removable lever handle.

.8 Butterfly Valves:
.1 NPS 2 1/2 through NPS 6, 2068 kPa with grooved ends.
.1 Body: cast bronze, with copper-tube dimensioned grooved ends.
.2 Disc: elastomer coated ductile iron with integrally cast stem.
.3 Operator: lever or handwheel.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 00.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
  .1 ASTM A125-96(2018)e1, Standard Specification for Steel Springs, Helical, Heat-Treated.
  .2 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  .3 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.

.2 Factory Mutual (FM)

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  .1 MSS SP-58-2018, Pipe Hangers and Supports - Materials, Design and Manufacture.

.4 American Society of Mechanical Engineers (ASME)
  .1 ASME B31.1–2018, Power Piping

.5 National Fire Code of Canada 2015

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
  .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
  .1 Submit shop drawings for:
    .1 Bases, hangers and supports.
    .2 Connections to equipment and structure.
    .3 Structural assemblies.

.4 Manufacturers' Instructions:
  .1 Provide manufacturer's installation instructions.
    .1 Contractor will make available 1 copy of systems supplier's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:
  .1 Deliver materials to site in original factory packaging, labelled

with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:
.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58.
.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58 and ASME B31.1.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:
.1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.
.2 Use electro-plating galvanizing processhot dipped galvanizing process.
.3 Ensure steel hangers in contact with copper piping are copper plated epoxy coated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:
.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
.1 Rod: 9 mm UL listed 13 mm FM approved.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed FM approved to MSS-SP 58.

.3 Upper attachment structural: suspension from upper flange of I-Beam:
.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved to MSS SP-58.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed FM approved.

.4 Upper attachment to concrete:
.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved to MSS SP-58.

.5 Shop and field-fabricated assemblies:
.1 Trapeze hanger assemblies.
.2 Steel brackets.
.3 Sway braces for seismic restraint systems in accordance with MSS SP-58 and ASME B31.1.

.6 Hanger rods: threaded rod material to MSS SP 58:
.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP 58:
.1 Attachments for steel piping: carbon steel black galvanized.
.2 Attachments for copper piping: copper plated black steel.
.3 Use insulation shields for hot pipework.
.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP-58 and UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.

.10 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A563.
.1 Finishes for steel pipework: black galvanized.
.2 Finishes for copper, glass, brass or aluminum pipework: black galvanized, with formed portion plastic coated epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58.

.12 Provide oversized pipe hangers/supports to accommodate insulation on following services:
.1 Chilled water.
.2 Domestic cold water.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP 58, type 42, UL listed FM approved.

.2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:
.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP-58, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:
.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-58.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.10 HOUSE-KEEPING PADS

.1 Extend, reconfigure and extend existing concrete pad to suit new air handler.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:
.1 Manufacturer's instructions and recommendations.

.2 Clamps on riser piping:
.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
.2 Bolt-tightening torques to industry standards.
.3 Steel pipes: install below coupling or shear lugs welded to pipe.
.4 Cast iron pipes: install below joint.

.3 Clevis plates:
.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

.1 Plumbing piping: National Plumbing Code of Canada.

.2 Fire protection: to applicable fire codes of National Fire Code of Canada.

.3 Copper piping: up to NPS 1/2: every 1.5 m.

.4 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.3 m	

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
- .2 Equalize loads.

.2 Adjustable clevis:
- .1 Tighten hanger load nut securely to ensure proper hanger performance.
- .2 Tighten upper nut after adjustment.

.3 C-clamps:
- .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:
- .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section includes heat tracing cables for pipes and tanks including controls and installation.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015)
.1 Safety Data Sheets (SDS).

.2 National Electrical Manufacturers Association (NEMA)

.3 Underwriter’s Laboratories (UL)

.4 Canadian Standards Association (CSA International)
.1 CSA C22.1-18 Canadian Electrical Code, Part I (24th edition), Safety Standard for Electrical Installations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00.
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.
.1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.

.2 Waste Management and Disposal:
.1 Waste Management and Disposal: Provide in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 EXTERNAL HEAT TRACING CABLE

.1 Cable shall be UL listed and CSA C22.1 certified system of heating cables, components and controls to prevent pipes from freezing.

.2 Constant wattage cables are not acceptable.

.3 Self-regulating heating cable shall consist of two (2) 1.5 mm2 (No. 16 AWG) bus wired embedded in parallel in self regulating polymer core that varies its power output to respond to temperature along its length, allowing the heating cable to be cut to length in the field. The heating cable shall be covered by a radiation-cross linked, modified polyolefin dielectric jacket. To provide a ground path and to enhance the heating cable's ruggedness, the heating cable shall have a braid of tinned copper and an outer jacket of modified polyolefin as required per section 62 of CEC.

.4 The heating cables shall have a outer insulating jacket with the following information clearly printed on the cable – cable model #, agency listings, meter marks & batch ID.

.5 In order to conserve energy and to prevent overheating, the heating cable shall have a self regulating factor of at least 90 percent. The self regulating factor is defined as the percentage reduction, without thermostatic control, of the heating cable output going from 4.4°C (40°F) pipe temperature operating to 65.6°C (150°F) pipe temperature operation.

.6 The heating cable shall operate on a line voltage of 208 volts single phase without the use of transformers.

.7 Where heating cable is provided within the building and is provided to prevent freezing in places that are heated but may experience periods of low temperatures such as loading docks, garbage rooms the heat tracing shall be selected based on a minimum ambient temperature of -17.8°C (0°F).

.8 Where heating cable is provided exterior to the building or in locations within the building that are not heated the heat tracing shall be selected based on a minimum ambient temperature of -28.9°C (-20°F).

.9 The heating cable for metal pipe freeze protection shall be sized according to the table below. The required heating cable output rating shall be in watts per foot at 10°C (50°F). Heating cable selection based on 25mm (1") of pipe insulation on metal piping.

	Minimum Ambient Temperature		
Pipe Size mm (Inches)	**-17.8°C (0°F)**	**-28.9°C (-20°F)**	**-40°C (-40°F)**
75mm (3") or less	5 watts	5 watts	12 Watts (208V) 2 strips – 5 watts (120 V)
100mm (4")	5 watts	8 watts	12 Watts (208V) 2 Strips – 8 watts (120 V)

.10 The power connection, end seal, splice and tee kit components shall be applied in the field.

.11 Heating cable circuit shall be protected by a ground fault device for equipment protection. This requirement shall be in accordance with section 62 of CEC.

2.2 COMPONENTS

.1 All heating cable components shall be UL listed and CSA C22.1 certified for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating cable core to expose the bus wires. Connection systems that required the installing contractor to strip to the bus wires or that use crimps or terminal blocks shall not be acceptable. All components that make an electrical connection shall be re-enterable for serving. No component shall use silicone seal to seal the electrical connections. An exception will be made in areas where a conduit transition is required.

2.3 SYSTEM CONTROL

.1 The system shall be controlled by an ambient sensing thermostat fixed at 4.4°C (40°F).

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 All lengths of cable shall be established by site measurement.

.2 Install heat tracing system in accordance with manufacturer's instructions.

.3 Apply power supply to heat tracing system on the pipe, only after piping has been pressure tested.

.4 Secure heating cable to piping with cable ties or fibreglass tape.

.5 Install "electric traced" nameplates to the outside of thermal insulation.

.6 Power connection, end seal, splice and tee kits components shall be installed in field as required.

3.3 FIELD QUALITY CONTROL

.1 Tests:
.1 Perform tests in accordance with Section 26 05 00.

.2 Use 500 V Megger to test cables for continuity and insulation value and

record readings before, during and after installation.

.3 Where resistance of 50 megohms or less is measured, stop work and advise Departmental Representative.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section shall be read in conjunction with and shall be governed by the requirements outlined in Section 23 05 00 of the specification.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015
.1 Safety Data Sheets (SDS).

.2 National Building Code of Canada 2015.

1.3 SUBMITTALS

.1 Submittals: in accordance with in accordance with Front End Documents and Section 23 05 00.

.2 Submit manufacturer's printed product literature, specifications and datasheet in accordance with in accordance with Front End Documents.
.1 Include product characteristics, performance criteria, and limitations.

.3 Submit shop drawings in accordance in accordance with Front End Documents prepared by the Departmental Representative.
.1 Provide separate shop drawings for each isolated system complete with performance and product data.
.2 Provide detailed drawings of seismic control measures for equipment and piping.
.3 Submit type of isolator, size, height when uncompressed and maximum allowable static deflection weight of all isolated equipment, loads on each isolator and static deflection of each isolator under the specific design load.
.4 Submit marked up plans indicating all locations where pipes are to be isolated in mechanical rooms, crossing acoustic joints and as specified.

.4 Quality assurance submittals: submit following in accordance in accordance with Front End Documents
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.
.3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 VIBRATION ISOLATOR GENERAL REQUIREMENTS

.1 All vibration isolators shall have either known undeflected heights or other markings so that after adjustment, when carrying their load, the deflection under load can be verified thus determining the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

.2 All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and shall be linear over a deflection range of 50 percent above the design deflection.

.3 The ratio of lateral to vertical stiffness shall not be less than 1.0 or greater than 2.0.

PART 2 - PRODUCTS

2.1 General

.1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 ELASTOMERIC PADS

.1 Type P1 neoprene waffle or ribbed; 9 mm (5/16") minimum thick; 50 durometer; maximum loading 350 kPa (50 psi).

.2 Type P2 rubber waffle or ribbed; 9 mm (5/16") minimum thick; 30 durometer natural rubber; maximum loading 415 kPa (60 psi).

.3 Type P3 neoprene steel neoprene; 9 mm (5/16") minimum thick neoprene bonded to 1.71 mm (16 gauge) steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers.

.4 Type P4 rubber steel rubber; 9 mm (5/16") minimum thick rubber bonded to 1.71 mm (16 gauge) steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers.

.5 Pads to be selected for 15% strain.

2.3 ELASTOMERIC MOUNTS

.1 Type M1 color coded; neoprene in shear; laterally stable maximum durometer of 60; threaded insert and two bolt down holes; ribbed top and bottom surfaces. All metal surfaces to be covered with neoprene. Mounts shall have leveling bolts rigidly secured to the equipment.

.2 Pads to be selected for 15% strain.

2.4 SPRINGS

.1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with leveling devices.

.2 Cadmium plate for outdoor and internal air handling installations.

.3 Color code springs. The spring diameter shall be not less than 80% of the compressed height of the spring.

.4 Unless otherwise specified, the minimum static deflection for equipment mounted on grade slabs shall be 25 mm (1") and the minimum static deflection for equipment mounted above the lowest level shall be 50 mm (2").

.5 Two isolation pads sandwiching a 1.71 mm (16 gauge) steel plate shall be bonded to the isolator base plate.

.6 Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene vibration isolation washer and sleeve shall be installed under the bolt head between the steel washer and the base plate.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 stable open spring: support on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 stable open spring: 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; internal adjustment; equipment bolting not necessary.

.4 Type M4 restrained stable open spring: supported on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad; built in resilient limit stops, removable spacer plates. Minimum clearance of 25 mm (1") shall be maintained around restraining boots and between the housing and the spring so as not to interfere with the spring operation. Limit stops shall be out of contact during normal operation, backed away from contact by at least 12 mm (1/2"); a neoprene washer shall be installed beneath the bolt head/washer used to restrain the isolator.

.5 Type M5 enclosed spring mounts with snubbers for isolation up to 23 kg (51 lbs) maximum.

2.6 HANGERS

.1 Color coded springs, rust resistant, painted box type hangers. Swivel arrangement to permit hanger box or rod to move through a 30° arc without metal to metal contact.

.2 Unless specified otherwise, the static deflection shall be 9 mm (3/8"), with a strain not exceeding 15%, and spring hangers to have minimum static deflection of 50 mm (2").

.3 A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 19 mm (3/8") larger than the diameter of the hanger rod.

.4 Type H1 neoprene in shear.

.5 Type H2 stable spring, elastomeric washer.

.6 Type H3 stable spring, elastomeric element.

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.8 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.9 RISER GUIDE

.1 For vertical isolated piping, riser guides shall be M 1 type isolators bolted to the vertical edge of a 90 degree steel angle. The angle shall allow the pipe to move axially but shall limit lateral movement to approximately +/- 25 mm (1").

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Provide vibration isolation for new equipment as noted in the specification, listed in the schedule and shown on the drawings.

.2 Install vibration isolation equipment in accordance with manufacturer’s instructions and adjust mountings to level equipment.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility.

.4 Ensure that piping and ducting passage through walls and floors do not transmit vibrations. A minimum of 25mm (1") clearance shall be allowed around the entire perimeter of the penetration. The clearance shall be packed with fibreglass and sealed with non hardening mastic on both sides.

.5 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25mm (1") minimum static deflection as follows:
.1 Up to NPS 4: first 3 points of support.
.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50mm (2").

.6 Unless specified otherwise, isolators indoors need not be bolted to the

floor. Where isolation is bolted to floor avoid short circuiting of sound pads by using vibration isolation rubber washers.

.7 Provide suitable supports for all equipment which does not have a frame with adequate rigidity.

.8 All steel bases shall clear the sub bases by at least 50mm (2"). All bases shall be blocked and shimmed level so that all ductwork and piping connections can be made to a rigid system, at operating level, before the isolation adjustment is made. The clearance shall be checked by the contractor to ensure that no scraps have been left to short circuit the vibration isolators.

.9 There shall be a minimum of 100mm (4") clearance between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.

.10 Piping, ductwork, conduit or mechanical equipment shall not be hung from or supported on other equipment, pipes or ductwork installed on vibration isolators. It shall be supported on or suspended from building structure.

.11 Equipment connected to fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping. Equipment should be blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims, and the Contractor shall confirm that the isolators for the fluid-filled pipes, pumps and other elements deflect the specified amounts and no more.

.12 All wiring connections to mechanical equipment on isolators shall be made in a 360 degree loop: minimum conduit length: 1m (3-ft). Cut any ties used to install this loop prior to adjusting the isolators.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents upon completion of the installation.
.2 Submit manufacturer's reports to Departmental Representative within 3 days of manufacturer representative's review.
.3 Make adjustments and corrections in accordance with written report.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA B149.1:20, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-24.3-92, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)
  .1 NFPA 13-2019, Standard for the Installation of Sprinkler Systems.

1.2 SUBMITTALS

.1 Product Data: submit product data for each item specified.

.2 Submittals: in accordance with Section 01 33 00.

.3 Product data to include paint colour chips, other products specified in this section.

.4 Samples:
  .1 Submit samples in accordance with Section 01 33 00.
  .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.3 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
  .1 Deliver, store and handle in accordance with Section 01 61 00.
  .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:
  .1 Equipment: manufacturer's name, model, size, serial number, capacity.
  .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:
.1 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:
.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:
.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:
.1 Terminal cabinets, control panels: use size #5.
.2 Equipment in Mechanical Rooms: use size #9.

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):
.1 Use arrangement of Main identifier, Source identifier, Destination identifier.
.2 Equipment in Mechanical Room:
.1 Main identifier: size #9.
.2 Source and Destination identifiers: size #6.
.3 Terminal cabinets, control panels: size #5.
.3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 PIPING SYSTEMS

.1 Identification:
.1 Natural gas to CSA B149.1
.2 Sprinklers: to NFPA 13.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.

.2 Pictograms:
.1 Where required: Workplace Hazardous Materials Information System (WHMIS 2015) regulations.

.3 Legend:
.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.4 Arrows showing direction of flow:
.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:
.1 To full circumference of pipe or insulation.
.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:
.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
.2 Other pipes: pressure sensitive plastic-coated cloth vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:
.1 Where not listed, obtain direction from Departmental Representative.
.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour Marking	Legend
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Make-up water	Yellow	MAKE-UP WTR
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Storm Water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

.1 Identification in English and French.

.2 Use one nameplate and label for each language both languages.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

.1 Provide identification only after painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and or CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PWGSC Preventive Maintenance Support System (PMSS).

3.4 NAMEPLATES

.1 Locations:
.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:
.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:
.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.
.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 90 days of award of contract.

.2 Provide documentation confirming AABC qualifications, successful experience.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Mechanical Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, caulking.

.5 All pressure, leakage, other tests specified elsewhere in Division 23.

.6 All provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

- .1 Other HVAC systems: plus 5%, minus 5 %.

.2 Hydronic systems: plus or minus 10%.

1.11 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.15 TAB REPORT

.1 Format to be in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:
.1 Project record drawings.
.2 System schematics.

.3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English, in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

.2 Provide manpower and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results to be at discretion of Departmental Representative.

.4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative , replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.18 COMPLETION OF TAB

.1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of this section or TAB standards of AABC.

.2 Do TAB of systems, equipment, components, controls:
.1 Building heat pumps, HRU and E/A fan.
.2 Garage S/A fans.

.3 Qualifications: personnel performing TAB to be current member in good standing of AABC qualified to standards of AABC.

.4 Quality assurance: Perform TAB under direction of supervisor qualified by to standards of AABC.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
.2 At controllers, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:
.1 Qualifications of TAB personnel: as for air systems specified this section.
.2 Quality assurance: as for air systems specified this section.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Definitions:
  .1 For purposes of this section:
    .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
    .2 "EXPOSED" - means "not concealed" as previouslydefined.
    .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
  .2 TIAC Codes:
    .1 CRD: Code Round Ductwork,
    .2 CRF: Code Rectangular Finish.

.2 Reference Standards:
  .1 ASTM International Inc.
    .1 ASTM C335/C335M-17, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
    .2 ASTM C449-07(2019), Standard Specification for Mineral Fiber Hydraulic Setting Thermal Insulating and Finishing Cement.
    .3 ASTM C553-13(2019), Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
    .4 ASTM C612-14(2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
    .5 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  .2 Canadian General Standards Board (CGSB)
    .1 CGSB 51-GP-52Ma-09, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  .3 Thermal Insulation Association of Canada (TIAC)
    .1 National Insulation Standards (2015)
  .4 Underwriters Laboratories of Canada (ULC)
    .1 CAN/ULC-S102:2018-REV1, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
  .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturers' Instructions:
  .1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Qualifications:
  .1 Installer: specialist in performing work of this section, and have

at least three (3) years successful experience in this size and type of project, qualified to standards member of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102.1:
.1 Maximum flame spread rating: 25.
.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
.1 Mineral fibre: to ASTM C553.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:
.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:
.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:
.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921 untreated.

.5 Tape: self-adhesive, aluminum reinforced, 50 mm wide minimum.

.6 Contact adhesive: quick-setting
.1 Maximum VOC limit 250 g/L.

.7 Canvas adhesive: washable.
.1 Maximum VOC limit 250 g/L.

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.10 Facing: 25 mm stainless steel hexagonal wire mesh stitched on both faces of insulation.

.11 Fasteners: 4 mm diameter pins with 35 mm diameter or clips, length to suit thickness of insulation.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29.
.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	25
Round cold and dual temperatire supply air ducts	C-2	yes	25
Supply, return and exhaust ducts exposed in space being served			none
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	50
Exhaust duct between dampers and plenum	C-1	no	25
Rectangular ducts outside	C-1	special	50
Acoustically lined ducts	none		

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.
.1 Finishes: conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
.1 ASHRAE Standard 90.1(SI)-2019 Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IESNA co-sponsored.

.2 American Society for Testing and Materials International (ASTM)
.1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
.2 ASTM C335/C335M-17, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
.3 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
.4 ASTM C449-07(2019), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
.5 ASTM C533-17, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
.6 ASTM C547-19, Standard Specification for Mineral Fiber Pipe Insulation.
.7 ASTM C795-08(2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
.8 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)
.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Department of Justice Canada (Jus)
.1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.
.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015)
.1 Safety Data Sheets (SDS).

.6 Manufacturer's Trade Associations
.1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide(Revised 2013).

.7 Underwriters' Laboratories of Canada (ULC)
.1 CAN/ULC-S102:2018, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
.2 CAN/ULC-S701.1:17, Standard for Thermal Insulation, Polystyrene

Boards.

.3 CAN/ULC-S702.1:2014-AMD1, Standard For Mineral Fibre Thermal Insulation For Buildings

.4 CAN/ULC-S702.2-15, Standard For Mineral Fibre Thermal Insulation For Buildings, Part 2: Installation.

1.3 DEFINITIONS

.1 For purposes of this section:
.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:
.1 CRF: Code Rectangular Finish.
.2 CPF: Code Piping Finish.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS).

.3 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 33 00.
.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.5 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: specialist in performing work of this Section, and have at least three (3) years successful experience in this size and type of project, qualified to standards member of TIAC.

.2 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:
.1 Protect from weather, construction traffic.
.2 Protect against damage.
.3 Store at temperatures and conditions required by manufacturer.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.1.
.1 Maximum flame spread rating: 25.
.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
.1 Mineral fibre: to CAN/ULC-S702.1 and ASTM C547.
.2 Maximum "k" factor: to CAN/ULC-S702.1.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
.1 Mineral fibre: to CAN/ULC-S702.1 and ASTM C547.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to CAN/ULC-S702.1 and ASTM C547.

.5 TIAC Code C-2: mineral fibre blanket faced with without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
.1 Mineral fibre: to CAN/ULC-S702.1 and ASTM C547.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to CAN/ULC-S702.1 and ASTM C547.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.7 Insulation: with vapour retarder jacket
.1 Jacket: to CGSB 51-GP-52Ma.
.2 Maximum "k" factor:.
.3 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:
.1 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/m3.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):
.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
.2 Colours: to match adjacent finish paint by Departmental Representative.
.3 Minimum service temperatures: -20°C.
.4 Maximum service temperature: 65°C.
.5 Moisture vapour transmission: 0.02 perm.
.6 Thickness: mm.
.7 Fastenings:
.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
.2 Tacks.
.3 Pressure sensitive vinyl tape of matching colour.
.8 Special requirements:
.1 Outdoor: UV rated material at least 0.5 mm thick.

.2 Canvas:
.1 220 gm/m3 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.2 Lagging adhesive: compatible with insulation.

.3 Aluminum:
.1 To ASTM B209M.
.2 Thickness: .50 mm sheet.
.3 Finish: smooth, stucco embossed, corrugated.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:
.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: valves, primary flow measuring elements flanges and unions at equipment.

.2 Design: to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:
.1 Insulation, fastenings and finishes: same as system.
.2 Jacket: PVC.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturer’s instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.
.1 Securements: SS wire bands at 300 mm on centre.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.
.1 Securements: SS wire bands at 300 mm on centre.
.2 Seals: VR lap seal adhesive, VR lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.
.1 Insulation securements.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code.

.5 TIAC Code: C-2 with without vapour retarder jacket.
.1 Insulation securements:.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.6 Thickness of insulation as listed in following table.
.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	**Temp °C**	**TIAC code**	**Pipe sizes (NPS) and insulation thickness (mm)**			
			to 1	**1-1/4 to 2**	**2-1/2 to 4**	**over**
Domestic HWS		A-1	25	25	25	38
Domestic CWS with vapour retarder		C-2	25	25	25	25
Cooling Coil cond. drain		C-2	25	25	25	25

.7 Finishes:
.1 Exposed indoors: hot water, PVC jacket.
.2 Exposed in mechanical rooms: PVC jacket for hot water.
.3 Concealed, indoors: canvas on valves, fittings. No further finish.
.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
.5 Outdoors: water-proof, aluminum jacket.
.6 Finish attachments: SS screws, bands, at 150 mm on centre. Seals: wing closed.
.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 22 42 01 - Plumbing Specialties and Accessories.

.2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:
.1 Verify performance of equipment and systems as specified elsewhere in Mechanical Division.
.2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
.3 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

1.3 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Buried systems: Perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.

.5 Cleanouts: Refer to Section 22 42 01.

1.4 REPORTS

.1 In accordance with Section 01 33 00 Submittal Procedures.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 23 05 05 - INSTALLATION OF PIPEWORK MECHANICAL.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
- .1 ASME B16.22-2018, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
- .2 ASME B16.24-2016, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
- .3 ASME B16.26-2018, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .4 ASME B31.5-2016, Refrigeration Piping and Heat Tranfer Components.

.2 ASTM International
- .1 ASTM A307-14el, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM B280-20, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 ASTM B88M-20, Seamless Copper Water Tube (Metric).

.3 Canadian Standards Association (CSA)
- .1 CSA B52-18, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

.5 EPS 1/RA/1-96, Environmental Code of Practice for the Reduction of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 TUBING

.1 Mechanical Contractor is responsible for providing all of the required refrigerant piping from the Heat Pumps to the condensing units as indicated on the standard detail M901. Contractor shall verify the refrigerant pipe sizing.

.2 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
- .1 Hard copper: to ASTM B88M.
- .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121°C.

.2 Brazed:
.1 Fittings: wrought copper to ASME B16.22.
.2 Joints: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:
.1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
.2 Gaskets: suitable for service.
.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:
.1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moistureproof seal for below freezing applications, brazed connections.

PART 3 - EXECUTION

3.1 GENERAL

.1 In accordance with Section 23 05 05, supplemented as specified herein

.2 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.

3.2 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.3 PIPING INSTALLATION

.1 General:
.1 Soft annealed copper tubing: bend without crimping or constriction Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Hot gas lines:

.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
.2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
.3 Provide inverted deep trap at top of risers.
.4 Provide double risers for compressors having capacity modulation.
.1 Large riser: install traps as specified above.
.2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.4 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low pressure sides respectively.

.3 Test Procedure: Build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.5 DEHYDRATION AND CHARGING

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13°C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
.1 Twice to 14Pa absolute and hold for 4 h.
.2 Break vacuum with refrigerant to 14kPa.
.3 Final to 5Pa absolute and hold for at least 12 h.
.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
.5 Submit test results to Departmental Representative.

.7 Charging:
.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:
.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
.2 Record and report measurements to Departmental Representative.

3.6 INSTRUCTIONS

.1 Post instructions in frame with glass cover in accordance with Section 01 78 00 and CSA B52.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 ASTM International.
.1 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
.2 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).
.1 Canadian Environmental Protection Act (CEPA), 1999, c.33.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015).
.1 Safety Data Sheets (SDS).

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
.1 ANSI/SMACNA 012-2006, SMACNA HVAC Duct Construction Standards - Metal and Flexible.
.2 ANSI/SMACNA 016-2012, HVAC Air Duct Leakage Test Manual.
.3 SMACNA 008-2007, IAQ Guidelines for Occupied Buildings Under Construction.

.6 Transport Canada (TC).
.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS SDS - Safety Data Sheets for the following:
.1 Sealants.
.2 Tape.
.3 Proprietary Joints.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.2 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

TABLE PRESSURE CLASSIFICATION

Ductwork	Operating Pressure	Seal Classification	Remarks
Supply Air Ductwork Upstream of VAV Boxes	Up to 500 Pa	B	
Supply Air Downstream of VAV Boxes	250 Pa	C	
Return Air Ductwork	Up to -250 Pa	C	
Exhaust and Outside Air Intake Plenums	Up to +/- 250 Pa	B	
All Other Ductwork Not Listed Above	Up to 125 Pa (0.5" wg)	C	

.2 Seal classification:
.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
.3 Class C: transverse joints and connections made air tight with gaskets sealant tape or combination thereof. Longitudinal seams unsealed.
.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with ANSI/SMACNA 016.

2.5 FITTINGS

.1 Fabrication: to ANSI/SMACNA 012.

.2 Radiused elbows.
- .1 Rectangular: standard radius short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
- .2 Round: smooth radius five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:
- .1 To 400 mm: with single double thickness turning vanes.
- .2 Over 400 mm: with double thickness turning vanes.

.4 Branches:
- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.

.5 Transitions:
- .1 Diverging: 20 degrees maximum included angle.
- .2 Converging: 30 degrees maximum included angle.

.6 Offsets:
- .1 Full short radiused elbows as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.
- .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation.

.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z275 zinc coating.

.2 Thickness, fabrication and reinforcement: to ANSI/SMACNA 012.

.3 Joints: to SMACNA proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29.
.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
.1 Maximum size duct supported by strap hanger: 500.
.2 Hanger configuration: to ASHRAE and SMACNA.
.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:
.1 For concrete: manufactured concrete inserts.
.2 For steel joist: manufactured joist clamp steel plate washer.
.3 For steel beams: manufactured beam clamps.

PART 3 - EXECUTION

3.1 GENERAL

.1 Do work in accordance with SMACNA as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
.1 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated

.3 Support risers in accordance with ANSI/SMACNA 012 as indicated.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with ANSI/SMACNA 012.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ANSI/SMACNA 012 as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:
- .1 Fresh air intake.
- .2 Exhaust air discharge.

.2 Form bottom of horizontal duct without longitudinal seams.
- .1 Solder weld joints of bottom and side sheets.
- .2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards fume hoods served.
- .1 Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve trap primer and discharging to open funnel drain as indicated.

3.4 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
.1 ANSI/SMACNA 012-2006, SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Flexible connections.
.2 Duct access doors.
.3 Turning vanes.
.4 Instrument test ports.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Manufacture in accordance with ANSI/SMACNA 012.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 0.66 mm thick with fabric clenched by means of double locked seams.

.2 Material:
.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40°C to plus 90°C, density of 1.3 kg/mý.

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene foam rubber.

.4 Hardware:
.1 Up to 300 x 300 mm: two sash locks complete with safety chain.
.2 301 to 450 mm: four sash locks complete with safety chain.
.3 451 to 1000 mm: piano hinge and minimum two sash locks.
.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
.5 Hold open devices.
.6 300 x 300 mm glass viewing panels.

2.4 TURNING VANES

.1 Factory or shop fabricated single thickness double thickness with without trailing edge, to recommendations of ANSI/SMACNA 012 and as indicated.

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Flexible connections:
.1 Install in following locations:
.1 Inlets and outlets to supply air units and fans.
.2 Inlets and outlets of exhaust and return air fans.
.3 As indicated.
.2 Length of connection: 100 mm.
.3 Minimum distance between metal parts when system in operation: 75 mm.
.4 Install in accordance with recommendations of ANSI/SMACNA 012.
.5 When fan is running:
.1 Ducting on sides of flexible connection to be in alignment.
.2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:
.1 Size:
.1 600 x 600 mm for person size entry.
.2 450 x 450 mm for servicing entry.
.3 300 x 300 mm for viewing.

.4 As indicated.
.2 Locations:
.1 Fire dampers.
.2 Control dampers.
.3 Devices requiring maintenance.
.4 Required by code.
.5 Reheat coils.
.6 Elsewhere as indicated.

.3 Instrument test ports.
.1 General:
.1 Install in accordance with recommendations of ANSI/SMACNA 012 and in accordance with manufacturer's instructions.
.2 Locate to permit easy manipulation of instruments.
.3 Install insulation port extensions as required.
.4 Locations.
.1 For traverse readings:
.1 Inlets and outlets of other fan systems.
.2 Main and sub-main ducts.
.3 And as indicated.
.2 For temperature readings:
.1 At outside air intakes.
.2 In mixed air applications in locations as approved by Departmental Representative.
.3 At inlet and outlet of coils.
.4 And as indicated.

.4 Turning vanes:
.1 Install in accordance with recommendations of ANSI/SMACNA 012 and as indicated.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI) / Sheet Metal and Air Conditioning National Association (SMACNA)
.1 ANSI/SMACNA 012-2006, SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 SUBMITTALS

.1 Shop Drawings and Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Manufacture to ANSI/SMACNA 012 standards.

2.2 SPLITTER DAMPERS

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Single Double thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of ANSI/SMACNA 012, except maximum height 100 mm as indicated.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of ANSI/SMACNA 012.

.3 Maximum blade height: 100 mm.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Maximum leakage: 0.07% at 750 Pa.

.8 Provide staff extension and standoff for insulated ducts.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated and required to balance system.

.2 Install in accordance with recommendations of ANSI/SMACNA 012 and in accordance with manufacturer's instructions.

.3 Install balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
.1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
.2 ASTM B209-01, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.2 Air Movement and Control Association International (AMCA International)
.1 AMCA 511-13, Certified Ratings Program Product Rating Manual for Air Control Devices

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
.1 ANSI/SMACNA 012-2006, SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Performance data.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 MULTI-LEAF DAMPERS

.1 Opposed and or Parallel blade type as indicated.

.2 Extruded aluminum to ASTM B209, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets,

complete with plated steel control rod.

.5 Operator: To be supplied and installed by control sub-contractor.

.6 Performance:
.1 Leakage: in closed position in accordance with Class 1 leakage at 1 kPa according to AMCA 511.
.2 Standard air leakage data to be certified under the AMCA certified ratings program.
.3 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s.

.7 Insulated aluminum dampers:
.1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
.2 Blades: constructed from aluminum extrusions to ASTM B209 with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.
.3 Provide insulated damper for dampers exposed to outside air.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of ANSI/SMACNA 012 and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Ensure dampers are observable and accessible.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This Section of the Specification shall be read in conjunction with and be governed by the requirements of Section 23 05 00 Common Work Results - Mechanical.

1.2 SUMMARY

.1 Section Includes:
- .1 Fire dampers and fire stop flaps.
- .2 Sustainable requirements for construction and verification.

1.3 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
- .1 ANSI/NFPA 90A 2021, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S112-10 (R2016), Standard Method of Fire Test of Fire Damper Assemblies.
- .2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .3 ULC-S505-74, Standard for Fusible Links for Fire Protection Services.
- .4 UL 555-06, Safety Fire Dampers.

1.4 PRODUCT DATA

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Front End Documents prepared by the Construction Manager and Section 23 05 00. Include product characteristics, performance criteria, and limitations.

.2 Indicate the following:

- .1 Fire dampers.
- .2 Fire stop flaps.
- .3 Operators.
- .4 Fusible links.
- .5 Design details of break-away joints.

1.5 QUALITY ASSURANCE SUBMITTALS

.1 Submit following in accordance with Front End Documents and section 23 05 00.

- .1 Instructions: submit manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Front End Documents prepared by the Construction Manager and Section 22 05 02.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Front End Documents.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.8 SAMPLE FOR THE BUILDING INSPECTOR

.1 At the start of construction the Mechanical Contractor complete the installation of one fire damper to provide a sample for review by the Building Inspector.

.2 The Mechanical Contractor shall arrange to have the Building Inspector and the Departmental Representative review the installation prior to proceeding with the installation of the remainder of the fire dampers on the site. Any modifications requested by the Building Inspector shall be rectified.

.3 All fire dampers for the project shall be installed in accordance with these samples.

1.9 DAMPER INSTALLATION REPORT

.1 The installation of each fire damper on site shall be documented during its installation by the Mechanical Contractor. The Contractor shall submit the completed fire damper schedules and submit all of the information below to the Departmental Representative prior to Substantial Completion.

.2 It is very important that the Mechanical Contractor understands these requirements and coordinates the collection of the required documentation as Construction proceeds. It will not be possible to meet these requirements if the documentation is left until the dampers are fully installed.

.3 Fire Dampers

.1 The contractor shall provide the following information to the Departmental Representative in the form of the fire damper schedule which is included in the contract documents. The fire damper schedule shall be completed by the Mechanical Contractor and each of these items shall be confirmed with a check mark, the Reviewers initials and the date.

.1 Stage 1 - Prior to the Installation of Retaining Angles.

.1 Confirm that the Clearance around Dampers meets the Manufacturer’s requirements.
.2 Confirm that the Damper is positioned within the Fire rated Assembly
.3 Confirm installation of duct access door
.4 Include a photo of the Damper without the retaining angles.
.5 Confirm and identify which damper installation was witnessed by Inspector.

.2 Stage 2 - After the Installation of the Retaining Angles.

.1 Confirm that retaining Angle size and installation meets Manufacturer's requirements.
.2 Confirm installation of Lamacoid Plate with Tag No.
.3 In drywall ceilings confirm Installation of Ceiling Access Door.
.4 Confirm that the damper can be accessed through the access door for future maintenance.
.5 Include a photo of the Damper with the retaining angles installed.
.6 Confirm and identify which damper installation was witnessed by Inspector.

PART 2 - PRODUCTS

2.1 FIRE DAMPERS

.1 Fire dampers shall be listed, bear a label of ULC approval, shall conform to the requirements of UL555 Standard for Fire Dampers and shall meet with requirements of NFPA 90A and Authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.

.2 Unless otherwise noted on the drawings, furnish "Type B" fire dampers for rectangular or square ductwork and "Type C" fire dampers for round ductwork.

.3 Furnish fire dampers and frame constructed of same material as the duct in which they are installed. Damper(s) shall be factory fabricated for fire rating requirements to maintain integrity of fire wall and/or fire separation.

.4 Top hinges shall be offset, round or square; multi blade hinged or interlocking type and sized to maintain full duct cross section.

.5 Fusible link actuated. Fusible link shall be rated for 74°C. (165°F) unless otherwise noted on the drawings. Dampers shall be provided with closing features as follows:
.1 Vertical Fire Damper with Horizontal Air Flow:
.1 Weighted to close and lock in closed position when released.
.2 Horizontal Fire Damper with Vertical Air Flow or MultiLeaf Fire Dampers:
.1 Provided with a stainless steel closure spring.

.6 Angle Iron Frames:

.1 Duct sizes less than 1200 mm (48") width or 1500 mm (60") in height provide the following:

.1 1-1/2" x 1-1/2" x 16 gauge (40 mm x 40 mm x 16 gauge) angle iron on full perimeter of frame on both sides of the wall or floor being pierced. Angles shall be fastened to the sleeves with one (1) of the following:

.1 1/4" (6 mm) diameter nuts and bolts.
.2 Welding 6" (150 mm) on centre.
.3 No.10 sheet metal screws 6" (150 mm) on centre.
.4 3/16" (5 mm) steel pop rivets.

.2 Duct sizes 48" (1200 mm) width or 60" (1500 mm) height or greater, provide the following:

.1 1-1/2" x 1-1/2" x 1/8" (40 x 40 x 3 mm) angle iron on full perimeter of frame on both sides of wall or floor being pierced. Angles shall be fastened to the sleeves with one (1) of the following:
.1 1/4" (6 mm) diameter nuts and bolts.
.2 Welding 6" (150 mm) on centre.
.3 No. 14 sheet metal screws 8" (200 mm) on centre.
.4 3/16" (5 mm) steel pop rivets.

.7 The maximum single damper of a multiple damper assembly shall be 60" x 54" (1530 mm x 1375 mm) in vertical mountings and 40 x 36” (1000 mm x 900 mm) in horizontal mountings. In cases where the openings are larger than these dimensions, a 12" (300 mm) wide brick or reinforced concrete mullion shall be provided between adjacent assemblies.

.8 Sleeves shall be of the same gauge or heavier than the duct they are connecting to. Sleeves shall extend 3" (75 mm) on either side of the wall or floor to facilitate the joining of the sleeve to the duct. In cases where the width of the retaining angle is such that it would inhibit joining the sleeve to the duct, the collar may extend approximately 2" (50 mm) beyond the edge of the angles.

.9 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 FIRE STOP FLAPS

.1 Fire stop flaps shall be ULC listed and labelled and fire tested in accordance with CAN4 S112.2.

.2 Blades shall be galvanized steel with ceramic fibre insulation (non asbestos). Frame shall be galvanized. Pins and hinges shall be corrosion resistant.

.3 Flaps to be held open with fusible link conforming to ULC S505 and close at 165°F (74°C).

.4 Maximum size of fire stop flap shall be 24" x 24" (600 x 600 mm).

.5 Where fire stop flaps are provided for square ceiling diffusers, provide ceramic fibre thermal blanket on the back of the ceiling diffuser. Size of blanket shall match ceiling diffuser size.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.2 General:

.1 Maintain integrity of fire wall and/or fire separation.

.2 For fire dampers provide an access door adjacent to the damper to allow for inspection of the damper.

.3 After completion and prior to concealment, obtain approvals of complete installation.

.4 Provide fire stop flaps on any grilles penetrating fire rated ceilings.

.5 The Mechanical Contractor shall review the Architectural Drawings. Any discrepancies between fire damper locations and the fire rated walls shall be brought to the attention of the Departmental Representative.

.6 Co-ordinate with installer of firestopping.

.7 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.8 Install break away joints of approved design on each side of fire separation.

.9 Ensure that the installation is witnessed by the Inspector or “AUTHORITY HAVING JURISDICTION”.

.3 Fire Dampers:

.1 Install fire dampers in accordance with NFPA 90A, UL555 and suppliers instructions, complete with retaining angles on both sides of wall or floor and fastened to damper collars.

.2 Minimum size of the opening for the fire damper shall be larger than the fire damper by 1/8" (3 mm) for each 12" (300 mm) of width or height of the damper to allow for expansion. The maximum allowable size of the opening shall be 1/2" (12 mm) larger in either dimension than the allowable minimum size.

.1 Example, a sleeve dimension of 36" x 48" (900 x 1200 mm) shall have an opening of 36-3/8" x 48-1/2" (912 x 1212 mm) The maximum opening size shall be 36-7/8" x 49" (924 x 1224 mm).

.3 The damper shall be connected to the sleeve by one (1) of the following methods:

.1 Where the sleeve is the same metal gauge as the duct, the duct shall be connected to the sleeve utilizing one (1) of the approved slip joints.

.2 Where the sleeve is 16-gauge up to 36" x 24" (900 x 600 mm) and 14-gauge for sizes exceeding 36" x 24" (900 x 600 mm) the duct may be connected with a rigid or fixed joint.

.4 The damper shall be centred horizontally in the opening and all of the clearance in the vertical plane shall be at the top.

.5 Dampers shall not be cast-in-place. Retaining angles and damper shall not be fastened directly to the wall or floor.

.6 The damper shall be installed in the plane of the fire separation.

.7 Provide lamacoid plate with damper identification tag. ID shall match the damper schedule.

.4 Fire Stop Flaps:

.1 Fire stop flaps shall be installed in accordance with NFPA 90A and the supplier's instructions

.2 Acceptable Mounting Method:

.1 Support the duct with two (2) 16 gauge, cold rolled steel support channels. Place the support channels at the bottom of the duct, adjacent to both sides of the duct drop. Install the ceiling fire stop flap in the duct drop using 3/16" (5 mm) diameter by 1/2" (12 mm) long steel bolts, No. 8 sheet metal screws or 3/16" (5 mm) diameter steel rivets.

.3 Provide No. 12 galvanized steel wire hangers to independently support the channels to the structural members of the floor or roof above.

.4 Clearance between each side of the ceiling fire stop flap and the duct drop shall be 1/8" (3 mm).

.5 The grille or diffuser shall be attached to the duct drop or ceiling fire stop flap using No. 8 by 1/2" (12 mm) sheet metal screws at 8" (200 mm) on centre and at least one (1) screw per side. The grille or diffuser flange shall overlap the ceiling opening by a minimum of 1" (25 mm).

3.3 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  .1 ANSI/SMACNA 012-2006, SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 Underwriter's Laboratories of Canada (ULC)
  .1 CAN/ULC-S110-13 Standard Method of Tests for Air Ducts.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
  .1 Thermal properties.
  .2 Friction loss.
  .3 Acoustical loss.
  .4 Leakage.
  .5 Fire rating.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC ACOUSTIC INSULATED

.1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible glass fibre thermal insulation and sleeved by aluminum foil and Type M vapour barrier.

.2 Performance:
  .1 Factory tested to 3 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.
.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

	Frequency (Hz)				
Duct Diam:	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

.1 Install in accordance with: CAN/ULC-S110 and ANSI/SMACNA 012.

.2 Use type 5 throughout.

.3 Connections:
.1 Duct Sizes 300 mm and Under:
.1 Provide a minimum of three (3) #8 sheet metal screws equally spaced to hold the flexible duct.
.2 Duct sizes above 300 mm:
.1 Provide a minimum of five (5) #8 sheet metal screws equally spaced to hold the flexible duct.
.3 Screws shall be located at least 12 mm from the end of the duct.
.4 The collar to which the flexible duct is attached shall be a minimum 50 mm in length.
.5 Cover entire joint with tape and seal as specified in Section 23 33 00.

.4 Supports:
.1 Support shall be in accordance with ANSI/SMACNA 012.
.2 The maximum amount of sag for flexible duct shall not exceed 12 mm per foot. Provide additional supports as required.

.5 Length:
.1 Maximum length of flexible duct: 3000 mm.
.2 Minimum length of flexible duct connecting to ceiling diffusers shall be 1800 mm.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

.2 Section 23 05 48 – Vibration Isolation.

.3 Section 23 33 00 - Air Duct Accessories.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Air Movement and Control Association (AMCA)
.1 ANSI/AMCA 99-2016, Standards Handbook.
.2 ANSI/AMCA 210-2016, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
.3 ANSI/AMCA 300-14, Reverberant Room Method for Sound Testing of Fans.
.4 ANSI/AMCA 301-14, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
.5 ANSI/AMCA 204-05(R2012), Balance Quality And Vibration Levels For Fans.

.2 Canadian General Standards Board (CAN/CGSB)
.1 CAN/CGSB-1.181-99, Coating, Zinc Rich, Organic, Ready Mixed.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Provide :
.1 Fan performance curves showing point of operation, BHP kW and efficiency.
.2 Sound rating data at point of operation.

.3 Indicate: Motors, sheaves, bearings, shaft details
.1 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00.
.1 Spare parts to include:
.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.6 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

PART 2 - PRODUCTS

2.1 FANS GENERAL

.1 Capacity: flow rate, total static pressure, bhp W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.2 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA 99.

.3 Sound ratings: comply with ANSI/AMCA 301, tested to ANSI/AMCA 300. Unit shall bear AMCA certified sound rating seal.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.5 Motors:
.1 In accordance with Section 23 05 13 supplemented as specified herein.
.2 For use with variable speed controllers.
.3 Sizes as indicated specified.

.6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and or outlet safety screens as indicated and as specified in Section 23 05 13. Inlet outlet dampers and vanes and as indicated.

.7 Factory primed before assembly in colour standard to manufacturer.

.8 Scroll casing drains: as indicated.

.9 Finish on fume hood exhaust fans:.

.10 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.11 Vibration isolation: to Section 23 05 48.

.12 Flexible connections: to Section 23 33 00.

2.2 CENTRIFUGAL FANS

.1 Fan wheels:
.1 Welded steel aluminum construction.
.2 Maximum operating speed of centrifugal fans not more than 40% of first critical speed.
.3 Air foil forward curved backward inclined blades, as indicated.

.2 Bearings: heavy duty split pillow-block flange mounted grease lubricated ball or roller self-aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 200,000 h.

.3 Shaft seals on laboratory fume hood and biological safety cabinet exhaust fans:
.1 Single disc multi-disc labyrinth water-cooled stuffing box carbon ring with nitrogen air purging seals.

.4 Housings:
.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, cast iron, steel, aluminum, for smaller wheels, braced, and with welded supports.

.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
.3 Provide bolted latched airtight access doors with handles.

.5 Variable volume control devices:
.1 Mounted by fan manufacturer.
.2 Adjustable inlet vanes: operated from a Centre mechanism linked to each damper vane. Support each vane at ends in bronze bearings. On DWDI fans interconnect vanes to operate in unison. Provide locking devices for manual operation.
.3 Variable Speed Drives.

2.3 DOWNBLAST (DB) AND UPBLAST (UB) FANS

.1 Fan:
.1 Fan shall be a spun aluminum, roof mounted centrifugal exhaust ventilator
.2 Provide upblast or downblast as indicated on the schedule.
.3 Provide V belt or direct drive in accordance with the schedule. For V belt fans provide adjustable motor sheave.
.4 Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners.
.5 The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection.
.6 The discharge baffle shall have a rolled bead for added strength.
.7 An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections.
.8 The motor shall be enclosed in a weather-tight compartment, separated from the exhaust airstream.
.9 Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA Certified Transit Tested Packaging.

.2 Wheel:
.1 Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. An aerodynamic aluminum inlet cone shall be provided for maximum performance and efficiency.
.2 Wheel shall be balanced in accordance with ANSI/AMCA 204.

.3 Bearing:
.1 Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron pillowblock housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

.4 Birdscreen:
.1 Provide 2.0 mm (1/12") diameter aluminum birdscreen.

.5 Roof Curb:
.1 Provide prefabricated 300 mm (12") high insulated roof curbs.
.2 Provide continuous curb gaskets and stainless steel securing bolts and screws.

.6 Direct drive fans
.1 As called for in the schedule shall be provided complete with variable speed controller. Where variable speed controllers are shown on the drawings, mount the controller in the location shown and provide wiring and conduit to the exhaust fan.
.2 Where the controller is not shown on the drawings mount the controller within the fan housing. The balancer will utilize this controller to set the correct air flow.
.3 Confirm mounting location of the variable speed controllers with the Departmental Representative prior to installation.

PART 3 - EXECUTION

3.1 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48, flexible electrical leads and flexible connections in accordance with Section 23 33 00.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

.5 Clean and dynamically balance existing return fan. Motor for existing return fan to be replaced. Provide new VFD for existing return fan.

3.2 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)
.1 NFPA 90A-2018, Installation of Air Conditioning and Ventilating Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Capacity.
.2 Throw and terminal velocity.
.3 Noise criteria.
.4 Pressure drop.
.5 Neck velocity.

1.3 CERTIFICATIONS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Provide standard product to meet capacity, throw, noise level, throat and outlet velocity.

.2 Where grilles, registers and diffusers penetrate fire walls and fire partitions, provide approved steel sleeve secured to structure in accordance with NFPA 90A and required fire damper.

.3 Frames:
.1 Steel: primed cold rolled steel with exposed welded joints and mitred corners.
.2 Aluminum: extruded satin finish with mechanical fasteners and mitred corners.
.3 Provide plaster frames as plaster stops where set into plaster or gypsum board.
.4 Provide concealed fasteners and balancing operators in all finished areas.
.5 Final finish to be selected by Departmental Representative from standard manufacturer finishes at shop drawing stage.
.6 Style, frame, and installation details as indicated on the schedule.

.4 Sizes and capacities: as indicated in the schedule.

2.2 SUPPLY GRILLES AND REGISTERS

.1 32 mm (1-1/4") border double deflection with airfoil shape horizontal face and vertical rear bars, opposed blade dampers (OBD) where indicated with concealed manual operator, and gaskets.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 32 mm (1-1/4") border, single deflection, air foil shape, horizontal bar type 35 max turn up, when shown on the schedule opposed blade damper with concealed operator and rubber sealing strips.

.2 Egg crate to be 12 x 12 x 25 mm (½" x ½" x 1"), type as per schedule.

.3 Perforated Grilles shall consist of a perforated core with 5mm(3/16") holes on 6mm (1/4") centres staggered 60 degrees and an extruded aluminum border. Finish in accordance with the schedule.

2.4 DIFFUSERS

.1 Diffusers shall consist of a precision formed back cone of one piece seamless construction which incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct.

.2 Refer to schedule for finish.

.3 As indicated on the schedule, Circular, square or perforated type, having adjustable fixed pattern, and volume control dampers with flow straightening devices and blank off quadrants.

.4 For plaque diffusers an inner plaque assembly shall be incorporated that drops no more than 6.35 mm below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck.

2.5 LINEAR GRILLES

.1 Bar core linear grilles with frame as indicated, plaster frame, sealing strip and accessories as indicated.

.2 All corners shall be mitred

.3 Floor grilles to be capable of supporting 90 kg (200 lb) point load weight between supports with negligible deflection.

.4 Provide opposed blade damper in maximum 1000 mm (3'0") lengths. Do not supply OBD in return air linear grilles.

.5 Extruded aluminum linear slot diffuser with adjustable vane controls and accessories as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer’s instructions.

.2 All diffusers and grilles in finished areas to have concealed mounting. In unfinished areas and where grilles or diffusers are to be installed in ductwork. For linear bar grilles and linear slot diffusers site measure for exact fit.

.3 Final locations of diffusers and grilles to be in accordance with details of Architectural reflected ceiling plan.

.4 Install and adjust air registers to provide noiseless and draftless distribution. Primary air balance to be done at duct dampers with final adjustment only at diffusers and grilles.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.

1.2 REFERENCES

.1 ASTM International
.1 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
.1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards - Metal and Flexible.
.2 ANSI/SMACNA 012-2012, HVAC Air Duct Leakage Test Manual.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:
.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
.2 Indicate following:
.1 Pressure drop.
.2 Face area.
.3 Free area.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00.
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.
.1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

.3 Test Reports:
.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 GOOSENECK HOODS

.1 Thickness: to ANSI/SMACNA 006.

.2 Fabrication: to ANSI/SMACNA 006.

.3 Joints: to ANSI/SMACNA 006.

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm diameter aluminum wire. Use 12 mm mesh on exhaust and 19 mm mesh on intake.

2.2 FIXED LOUVRES – ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy AA 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm exhaust and 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 For louvers within Generation Room provide security bars 13 mm ø steel rods at 152.4 mm OC welded to 114.3 mm steel frame.

.8 Finish: Powder coated, colour selection by Departmental Representative to coordinate with exterior metal wall panels.

2.3 LOUVERED PENTHOUSES

.1 Louvered penthouses shall have heavy gauge extruded aluminum blades, aluminum blades, aluminum alloy 6063-T5 extrusions of the storm blade style with corners mitered and welded. Roof and curb caps shall be formed of heavy gauge aluminum and the entire assembly braced by heavy interior upright angles at the corners and along the sides.

.2 Finish color to be selected by the Departmental Representative at the shop drawing stage.

.3 Louvers shall have aluminum birdscreen with 85 percent minimum free area.

.4 Penthouses shall be provided with prefabricated insulated roof curb.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturer's and ANSI/SMACNA 006 recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements of Section 22 05 00.

1.2 SUMMARY

.1 Section Includes:
.1 Filters and filter gauges for various types of mechanical air handling equipment.

1.3 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
.1 ASHRAE 52.2-2017 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
.1 Filters shall meet the rated performance specifications based on the ASHRAE 52.2 test method. Filters utilizing partial or complete synthetic media will be tested in compliance with pre-conditioning steps as stated in Appendix J.
.2 All testing is to be conducted on filters with a nominal 600 x 600 mm face dimension. Testing to be performed at an independent, commercially operated test lab or a test lab covered by an ISO 9000 quality/business system. All performance data to be supplied from the same individual test report.

.2 American National Standards Institute (ANSI)/Air-Conditioning, Heating, & Refrigeration Institute (AHRI)
.1 ANSI/AHRI 851-SI-2013 Performance Rating of Commercial and Industrial Air Filter Equipment
.1 Pertinent tolerances specified in Section 7.4 of the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 851 shall apply to the performance ratings.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015)
.1 Safety Data Sheets (SDS).

.4 Underwriters' Laboratories of Canada (ULC)
.1 CAN/ULC-S111-13(R2018), Standard Method of Fire Tests for Air Filter Units.

.5 Underwriters' Laboratories (UL)
.1 UL 900-2015, Standard for Air Filter Units.

1.4 SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and

datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 33 00, Section 01 78 00 and Section 23 05 00.

.3 Closeout Submittals
.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.5 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Provide in Accordance with Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: Provide in Accordance with Section 01 74 20.

1.7 MAINTENANCE

.1 Extra Materials:
.1 Submit in accordance with Section 01 78 00 Closeout Submittals
.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

PART 2 – PRODUCTS

2.1 GENERAL

.1 Filters: Suitable for air at 100% RH. Air temperatures up to 177°C (350°F).

.2 Provide filter types described herein for air to air energy recovery equipment as specified in Section 23 72 00.

2.2 LOCATIONS REQUIRED

Equipment	**Location**	**Type**	**MERV Rating**	**Depth**
Heat Recovery Units	Intake	Pleated Panel	8	50mm
Exhaust Air	(Heat Recovery)	Pleated Panel	8	50mm
Heat Pumps	Intake	Pleated Panel	8	25mm

2.3 FILTER PERFORMANCE

.1 Pleated Panel Filters (50mm (2″); MERV 8; UL 900 Class 2) (30 to 35% Dust Spot Efficiency)

.1 Each filter shall consist of an individual pleated media pack, enclosed in a clay coated board frame, with integral pleat stabilizers and support straps.

.2 The media shall be a blend of 100% virgin synthetic fibers. Media must also be self-supporting in pleated form, with no metal or plastic material laminated to the media to provide pleat support.

.3 The pleated media pack must be enclosed in a 1-piece, 28 pt. moisture resistant beverage carrier board frame. In addition to the perimeter frame, the filter must have three pleat stabilizers bonded to the media on the air leaving side and three support straps adhered to the air entering side of the filter. The pleat stabilizers must be made of moisture resistant beverage carrier board, and bonded to the media to maintain the proper pleat spacing throughout the life of the filter. The support straps are to be made from moisture resistant beverage carrier board and must be adhered along the tips of each pleat.

.4 Filters of the size and air flow capacity shall meet the following rated performance specifications based on the ASHRAE 52.2 test method. Pertinent tolerances specified in Section 7.4 of the Air-Conditioning and ANSI/AHRI 850 shall apply to the performance ratings. All testing is to be conducted on filters with a nominal 600 x600 (24″ x 24″) face dimension.

Minimum Efficiency Reporting Value	8
Dust Holding Capacity	105 grams
Nominal Size (Width x Height x Depth)	600x600x50 mm (24x24x2 inch)
Rated Air Flow Capacity	945 l/s (2000cfm)
Rated Air Flow Rate	2.5 m/s (500fpm)
Final Resistance	250Pa (1.0iwg)
Rated Initial Resistance	82.5Pa (0.33 iwg)

.5 The filters shall be approved and listed by Underwriters' Laboratories, Inc. as Class 2 when tested according to UL 900 and CAN/ULC-S111.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION GENERAL

.1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

3.3 REPLACEMENT MEDIA

.1 Prefilter shall be installed on initial start-up.

.2 Prior to the start of balancing install new prefilters and final filters.

.3 Replace all prefilters and final filters at turnover to the Departmental Representative. Used filters shall be inspected by the Departmental Representative. All filters in acceptable condition shall be retained by the Departmental Representative.

.4 Provide a spare set of pre and final filters in additional to the set identified in item 3.1.4 above.

.5 Spare HEPA filters are not required.

3.4 FIELD QUALITY CONTROL

.1 Verification requirements - Sustainable Requirements: Contractor's Verification include:
- .1 Materials and resources.
- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Low-emitting materials.

3.5 CLEANING

.1 Proceed in accordance Section 01 74 00.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 00.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015).
  .1 Safety Data Sheets (SDS).

.2 Underwriters' Laboratories (UL)
  .1 UL 900-2015 – Test Performance of Air Filter Units.
  .2 UL 1812-2013 – Ducted Heat Recovery Ventilators.

.3 National Electrical Manufacturers Association (NEMA)
  .1 NEMA 5-15R – Receptacles.

.4 Canadian Standards Association Group International (CSA)
  .1 CAN/CSA-C22.2 NO. 113-18 – Fans and Ventilators.

.5 Air-Conditioning, Heating and Refrigeration Institute (AHRI)
  .1 AHRI 1060-2013 - Performance Rating of Air-To-Air Heat Exchangers for Energy Recovery Ventilation Heat Equipment.

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheets in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations

.2 Shop Drawings:
  .1 Submit shop drawings in accordance with Section 23 05 00 and Section 22 05 00.
  .2 performance for summer and winter conditions.
  .3 Materials of Construction.
  .4 Frost threshold.
  .5 Controls Interface.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00.

.4 Closeout Submittals:
  .1 Provide operation and maintenance data for incorporation into manual in accordance with Section 01 78 00 and Section 22 05 02.

.5 Certificates:
  .1 Catalogued or published ratings: obtained from tests carried out by

manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
.2 Provide confirmation of testing.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions and in accordance with 01 61 00.

.2 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: provide in accordance with Section 01 74 20.

1.5 MAINTENANCE

.1 Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00.
.2 Furnish list of individual manufacturer's recommended spare parts for equipment include:
.1 Addresses of suppliers.
.2 List of specialized tools necessary for adjusting, repairing or replacing.

PART 2 - PRODUCTS

2.1 FANS

.1 Two (2) factory balanced fans with backward curved blades. Motors come with permanently lubricated sealed ball bearings and (TOP) thermal overload protected and maintenance-free operation.

2.2 HEAT RECOVERY CORE

.1 Fantech manufactures this fixed plate cross-flow heat exchanger using new 1100 alloy aluminum. Heat exchanger is engineered with a turbulence inducing geometry in order to maximize heat transfer while allowing an effective evacuation of condensate. The plates are hemmed and sealed to ensure no cross-contamination of airstreams. The aluminum core had a plastic handle for easy removal. The unit features two cores, each 305 mm x 305 mm (12" x 12") with a 380 mm (15") depth.

2.3 DEFROST

.1 A preset frost control sequence is initiated if the outdoor temperature falls below the set point of -5°C (23°F). During the initial stage, the supply blower shuts down & the exhaust blower switches into high speed to eliminate frost build-up in the core. The unit then returns to normal operation for the final stage of the frost control sequence at which time the sequence is repeated if the outdoor air temperatures is still below the set point.

2.4 SERVICEABILITY

.1 Cores, filters and drain pan can be accessed easily from both sides of the HRV from hinged access panels. Cores conveniently slide out with only 380 mm (15") clearance. Blowers can be accessed from both side of the HRV from fastened access panels. Blowers are easily removed by taking off the access panel and sliding the motor plates out of the HRV. A quick connect allows for fast inspection of blowers.

2.5 CASE

.1 0.7mm (24 gauge) galvanized steel. Baked power-coated paint for a superior adhesion and resistance.

2.6 INSULATION

.1 Insulated with 25 mm (1in) fiberglass with FSK facing for condensation control.

2.7 FILTERS

.1 The exhaust and fresh air streams are protected by MERV 1 washable filters constructed to meet UL 900. Optional MERV6 filters are direct replacement to the MERV 1. Use of MERV 6 filters will add an additional system pressure of 60 Pa (0.26in.wg) at 326 l/s (690 cfm).

2.8 CONTROLS

.1 Digital Controller provided with:
- .1 Display
  - .1 Multi-segment, backlit blue in color, touch capable.
- .2 Time of day
  - .1 Light intensity sensor.
- .3 Sensor accuracy
  - .1 Displayed RH depends on the room air movement.
- .4 Communication
  - .1 Custom 2 wire interface, 12Vdc not polarity sensitive.
- .5 Power
  - .1 12Vdc not polarity sensitive.
- .6 Connector
  - .1 2 wire screw terminal up to 18 AWG.
- .7 Plastics
  - .1 WHITE CWL 9519, Smooth matte surface finish.
- .8 Backplate
  - .1 Can be mounted using screws on drywall and/or on electrical enclosure NEMA 5-15R (Residential 120Vac single enclosure).
- .9 Ventilation Mode
  - .1 There are 3 possible ventilation modes. VENTILATION, RECIRCULATiON, STANDBY/OFF.
- .10 Warranty
  - .1 2 year warranty.

2.9 MOUNTING

.1 Unit may be suspended by using threaded rod, not supplied, or placed on a platform. Unit shall be adaptable for easy service of electrical components.

2.10 WARRANTY

.1 Limited lifetime on aluminum core, 3 years on motors, and 3 years on parts.

2.11 REQUIREMENTS AND STANDARDS

.1 Complies with the UL 1812 requirements regulating the construction and installation of Heat Recovery Ventilators.

.2 Complies with the CAN/CSA-C22.2 no. 113 Standard applicable to ventilators.

.3 Technical data was obtained from published results of test relating to AHRI 1060.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Provide start up reports from the manufacturer’s representative for both heating and cooling.

.3 Provide all wiring for controls and power wiring.

3.3 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 23 05 00.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS 2015).
.1 Safety Data Sheets (SDS).

.2 Canadian Standards Association Group International (CSA)
.1 CSA B52:18 – Mechanical Refrigerant Code.
.2 CSA C22.1-2018, Canadian Electrical Code Part I Safety Standard For Electrical Installations.

.3 Canadian Standards Association (CSA)/International Organization for Standardization (ISO)
.1 CAN/CSA-ISO 9001:16(R2020), Quality Management Systems – Requirements.
.2 CAN/CSA-ISO 14001:16, Environmental Management Systems.

.4 Underwriters' Laboratories (UL)
.1 UL STD 1995-2015 - Heating and Cooling Equipment.

.5 Air-Conditioning, Heating and Refrigeration Institute (AHRI)
.1 AHRI 1230-2014 - Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment.

.6 ASTM International
.1 ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus.
.2 ASTM G85-19, Standard Practice for Modified Salt Spray (Fog) Testing.

1.3 SUBMITTALS

.1 Provide in accordance with Section 01 33 00 and Section 22 05 00.

.2 Indicate the following: complete specifications; piping diagrams with piping lengths; refrigerant charge per system including CSA B52 analysis; wiring diagrams; weight; performance details at specified conditions.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with 01 61 00 Documents and manufacturer's written instructions.

.2 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal in accordance with 01 74 20.

PART 2 – PRODUCTS

2.1 GENERAL

.1 This section includes the design, performance, refrigerant details, controls and installation requirements for the VRV systems (variable refrigerant volume) system.

.2 All units shall be listed and rated by AHRI 1230 and meet all minimum IEER performance requirements as scheduled.

.3 The units shall be CSA approved, UL listed and listed by Electrical Testing Labs (ETL) and bear the CETL label.

.4 All wiring shall be in accordance with the CSA C22.1.

.5 The system will be produced in a CAN/CSA-ISO 9001 and CAN/CSA-ISO 14001 facility, which are standards set by the International Organization for Standardization (ISO). The system shall be factory tested for safety and function.

.6 The units and the design shall be in compliance with CSA B52.

2.2 SYSTEM DESCRIPTION

.1 The variable capacity air conditioning system shall be a Variable Refrigerant Volume system as specified. The system shall consist of multiple indoor unit evaporators, REFNET™ joints and headers, a two pipe refrigeration distribution system using PID control and VRV outdoor condensing unit. The outdoor condensing unit shall be a direct expansion (DX), air-cooled, multi-zone air-conditioning system with variable speed inverter driven scroll compressors using R-410A refrigerant. The condensing unit may connect to an indoor evaporator capacity up to 200% of the condensing unit capacity. Each zone shall be capable of operating separately with individual temperature control. The group of six (6) indoor A/C units shall maintain temperature set point via a local remote mounted controller with a centralized Intelligent touch screen controller as specified.

.2 Standard T style joints are not acceptable for a variable refrigerant volume system. Manufacturer specific Y joints shall be supplied by the VRV manufacturer.

2.3 VRV (VARIABLE REFRIGERANT VOLUME) FEATURES

.1 VRV system shall feature Variable Refrigerant Temperature, where the system automatically varies the target evaporating and condensing temperatures based on building load and weather conditions. The condensing unit shall also feature customizable operating modes which allows for the manual setting of target evaporating and condensing temperatures.

.2 Each system shall be available with a configurator software package to allow for remote configuration of operational settings and assessment of operational data and error codes. If this software is not provided by an alternate manufacturer, the contractor shall configure the settings manually for each individual outdoor unit and keep detailed records for

future maintenance purposes.

2.4 START-UP AND WARRANTY

.1 The system must be installed by a trained and certified contractor. The bidders shall be required to submit training certification proof with bid documents. Untrained contractors who wish to bid this project may contact the manufacturer to arrange training prior to bid day.

.2 The manufacturer shall provide a factory trained service technician to start-up each unit. Manufacturer shall provide instruction to the Departmental Representative on proper unit operation and maintenance.

.3 The warranty period on all parts and compressors shall commence on the date of Substantial Completion and shall continue for a period of Ten (10) years not to exceed one hundred and twenty six (126) months from date of shipment. Proper maintenance of the equipment, performed by approved technicians as per the manufacturer or manufacturer's representative, shall be conducted. Maintenance logs shall be supplied by the Departmental Representative upon request.

2.5 REFRIGERANT PIPING

.1 Refer and comply to the refrigerant piping specifications Section 23 23 00, including the special considerations for VRF refrigerant piping section.

.2 Units shall be designed for R-410A refrigerant.

2.6 250mm (10") CONCEALED CEILING DUCTED HEAT PUMP

.1 Indoor unit shall be a built-in ceiling concealed heat pump with variable speed direct drive DC type fan and auto CFM adjustment at commissioning. Casing shall be constructed of galvanized steel. Configuration shall be horizontal discharge air with horizontal return air, with a maximum height of 241 mm and be designed to fit in tight ceiling plenums.

.2 The indoor unit's sound pressure shall range from 28 dB(A) to 36 dB(A) at low speed measured 5 feet (1.5m) below the ducted unit.

.3 The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 635 mm of lift from the center of the drain outlet and have a built-in safety shutoff and alarm.

.4 The fan shall have a variable speed direct drive DC motor with statically and dynamically balanced impeller with 3 user-selectable fan speeds. The automatic fan speed mode shall allow the fan to vary between 5 speeds based on space load. The unit shall have logic for automatically adjusting external static pressure settings of the fan motor (selectable during commissioning).

.5 The unit shall ship from the factory in a rear return configuration and shall be field convertible to a bottom return configuration.

.6 Field installed MERV8 filters and filter kits with 25 mm filter depths.

2.7 VRV OUTDOOR CONDENSING UNITS

.1 The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a swing compressor, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separator, service ports and suction line accumulator.

.2 The outdoor system shall be able to support the connection of up to 10 indoor unit's dependent on the model of the outdoor unit.

.3 The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.

.4 The following safety devices shall be included on the condensing unit; high pressure switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.

.5 To ensure the liquid refrigerant does not flash when supplying to the various indoor unit units, the circuit shall be provided with a sub-cooling feature.

.6 Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.

.7 The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

.8 The condensing units shall have the dimensions and weights indicated in the equipment schedule.

.9 The condensing units shall have a SEER rating as high as 18 and a HSPF of 10.

.10 The condensing unit fan(s) shall consist of propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter.

.11 The fan motor shall have inherent protection and permanently lubricated bearings and shall be provided with a fan guard to prevent contact with moving parts.

.12 The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design manufactured from Hi-X seamless copper tube. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.

.13 The outdoor unit shall be capable of heating operation at -20C ambient temperature. Tested factory data on heating capacity and efficiency shall be available.

.14 The outdoor unit shall be capable of cooling operation down to -5C without

any additional low ambient controls.

2.8 SPLIT A/C UNIT (HP-09)

.1 The indoor A/C units shall be a wall mounted unit for installation onto a wall within a conditioned space. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment.

.2 The indoor unit’s sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 1m (3.3 feet) below and 1m (3.3 feet) away from the unit.

.3 The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart.

.4 The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.

.5 The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

.6 The fan type shall be direct-drive cross-flow with statically and dynamically balanced impeller with high and low fan speeds available.

.7 Indoor units shall be completely factory assembled and tested. Internal unit components shall be factory wired and piped, and complete with electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

.8 All refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.

2.9 OUTDOOR CONDENSING UNIT FOR SPLIT A/C (CU-05)

.1 The outdoor condensing unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of inverter scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver and suction accumulator.

.2 The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.

.3 The unit shall incorporate an auto-charging feature and a refrigerant charge check function to ensure proper refrigerant charge.

.4 The following safety devices shall be included on the condensing unit: high pressure sensor and switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter, and anti-recycling timers.

.5 To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.

.6 Oil recovery cycle shall automatically occur 2 hours after start of operation and then every 8 hours of operation.

.7 The inverter scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value.

.8 Non inverter-driven compressors, which may cause starting motor current to exceed the nominal motor current (RLA) and require larger wire sizing, shall not be allowed.

.9 The inverter driven compressor in each condensing unit shall be high efficiency reluctance DC (digitally commutating), hermetically sealed scroll “G-type” or “J-type”.

.10 Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. Upon complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.

.11 The compressors’ motors shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.

.12 Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.

.13 The compressor shall be internally isolated to avoid the transmission of vibration, eliminating the need for external spring insolation.

.14 In the event of compressor failure, for condensing units with multiple compressors, the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be designed to specifically address this condition.

.15 In the case of multiple condenser modules, conjoined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each: start/stop cycle, completion of oil return, completion of defrost, or every 8 hours of operation, extending the operating life of the system. When connected to

a central control system, sequential start is activated for all systems on each DIII network.

.16 The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish. The unit shall be modular in design and shall allow for side-by-side installation with minimum spacing requirements.

.17 The outdoor condensing unit shall be provided with manufactured roof mounting support frame c/w sleepers as indicated on the drawings.

.18 Air Cooled Condensing Unit

.1 The fan motor shall have inherent protection and permanently lubricated bearings. The motor shall be provided with a fan guard to prevent contact with moving parts. The condensing unit shall consist of one or more propeller type, direct-drive 350 or 750 W fan motors that have multiple speed operation via a DC (digitally commutating) inverter. Motors shall be capable of delivering design air at high external static pressures up to 0.32 in WG (factory set as standard at 0.12 in. WG) to accommodate field applied duct for indoor mounting of condensing units.

.2 Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature.

.3 The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.

.4 The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tubes with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design. The fins are to be covered with an anti-corrosion acrylic resin and type E1 hydrophilic film.

.5 The fins are to be covered with an anti-corrosion Ultra Gold coating as standard with a salt spray test rating of 1000hr (ASTM B117 & Blister Rating:10), Acetic acid salt spray test of 500hr (ASTM G85 & Blister Rating:10).

.6 The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.

.7 The outdoor coil shall have three-circuit heat exchanger design. The lower part of the coil shall be used for inverter cooling and be on or off during heating operation, enhancing the defrost operation.

2.10 CONTROLS

.1 Heat pumps shall be supplied with individual zone controllers

.2 Zone controllers shall be hard wired by installer.

.3 Controllers shall be able to function as follows:

.1 The controller shall have single and dual setpoints for occupied periods, and independent setback setpoints for unoccupied periods.

.2 The controller shall have the ability to digitally prohibit individual buttons and functions, including custom mode selection.

.3 The controller shall have a self diagnosis function that constantly monitors the system for malfunctions.

.4 The controller shall be equipped with a thermostat sensor.

.5 Controller shall have built-in 7 day, weekday plus Saturday Sunday

(5+1+1), weekday plus weekend (5+2) and everyday (1) scheduler.

2.11 ELECTRICAL/CONTROL WIRING

.1 The power supply to the outdoor condensing unit and indoor A/C units shall be as scheduled.

.2 The low voltage control wiring shall be 18 AWG 2-conductor stranded non-shielded wiring.

.3 Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit then to the branch selector box and outdoor unit. Control wiring shall run from the indoor unit terminal block to the specific controller for that unit.

.4 All power and/or control wiring shall be in conduits.

2.12 CAPACITY

.1 As indicated on the equipment schedule.

PART 3 – EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 DELIVERY, STORAGE AND HANDLING

.1 Units shall be stored and handled according to the manufacturer’s recommendations. Units shall be kept clean and isolated from dust and debris.

3.3 INSTALLATION

.1 Install outdoor condensing unit on a flat surface level within 3.2mm, and elevated a minimum of 457mm (18”) from ground or roof surface. Provide a manufacturer supplied intermediate supports as specified.

.2 Provide all necessary control wiring as recommended by the manufacturer.

.3 High/low pressure gas line, liquid, and suction lines must be individually insulated between the outdoor and indoor units.

.4 Contact the manufacturer prior to installation to review and confirm piping layout and lengths.

.5 Use refrigeration best practice to allow pipes to expand and contract freely. Review manufacturer installation instructions to ensure expansion joints are properly designed.

.6 Pressure test ALL systems to 3792kPa after system was vacuumed and held to below 500 microns for at least one hour. Review manufacturer installation instructions for proper pressure test procedures.

.7 Design and install all piping as per CSA B52 regulations, and apply and obtain TSSA certification for all systems.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 23 05 00.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 and Section 23 05 00.

.2 Submit product data sheets for baseboard convectors. Include: Product characteristics, Performance criteria, Mounting methods, Physical size, Cabinet material thicknesses, Limitations, Colour and finish.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for baseboard convectors.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Provide in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 All convector covers shall be factory painted with factory baked enamel finish. Colour to be chosen at shop drawings stage. A paint chip will be provided by the Departmental Representative.

.2 Provide for noiseless expansion of all components.

.3 Radiation to give output indicated on the schedule.

2.2 ELECTRIC WALL CONVECTORS

.1 Construction: 0.75mm (22 gauge) steel construction

.2 Heating elements:
.1 Nickel chromium element that is totally enclosed within a steel sheath, providing superior life expectancy and resistance to rust
.2 Shark-fin shaped aluminum fins are firmly staked in an upright position to provide directional wicking for the top discharge heat transfer

.3 Control & Wiring:
.1 Supply line can be brought in at either end
.2 Final connections must be made on right side
.3 Wire way to run wiring from left side

.4 Capacity as shown on drawings and identified in the schedules.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

.1 Maintain proper clearance around equipment to permit performance of service maintenance. Check final location with Departmental Representative if different from that indicated prior to installation.

.2 Should deviations beyond allowable clearances arise, request and follow Departmental Representative directive.

.3 Refer to manufacturer's installation drawings. Verify electrical service work with characteristics stamped on unit.

.4 Check that all openings for appurtenances and operating weight conform to shop drawings.

.5 Provide screwdriver vent on convectors and radiators. Clean all finned tubes and comb straight.

3.2 FIELD QUALITY CONTROL

.1 Ensure heaters and control operate correctly.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
  .1 CSA C22.2 No.46-13(R2018), Electric Air-Heaters.

.2 Efficiency Valuation Organization (EVO)
  .1 International Performance Measurement and Verification Protocol (IPMVP)
    .1 IPMVP Core Concepts 2014.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 and Section 23 05 00.

.2 Submit product data sheets for baseboard convectors. Include: Product characteristics, Performance criteria, Mounting methods, Physical size, Cabinet material thicknesses, Limitations, Colour and finish.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
  .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  .2 Store and protect unit heaters from nicks, scratches, and blemishes.
  .3 Replace defective or damaged materials with new.

.4 Waste Management and Disposal: Provide in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

.1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet vertical discharge radial type cone type with cone diffusers explosion proof.

.2 Fan type unit heaters with built-in high-heat limit protection, fan-delay switches.

.3 Fan motor: totally enclosed, permanently lubricated ball bearing type with resilient mount and explosion proof where noted.
.1 Built-in fan motor thermal overload protection.

.4 Hangers: as indicated.

.5 Elements: mineral insulated stainless steel sheath with aluminum, single continuous helical brazed fins.
.1 Explosion proof with sealed steel tube core with aluminum fin.

.6 Cabinet: aluminum.

2.2 CONTROLS

.1 Built in thermostat and support controls.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Suspend unit heaters from ceiling or mount on wall as indicated.

.2 Install thermostats in locations indicated.

.3 Make power and control connections.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure heaters and controls operate correctly.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by unit heaters installation.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 00.

.2 System Description: Open coil electric reheat coils designed for air heating applications using electric heat.

1.2 REFERENCES

.1 ASTM International
.1 ASTM B88M-20 - Specification for Seamless Copper Water Tube.
.2 ASTM B783-19 - Specification for Materials for Ferrous Powder Metallurgy (P/M) Structural Parts.

.2 Underwriter's Laboratories (UL)
.1 UL 1996-2009, Electric Duct Heaters.

.3 Air-Conditioning, Heating, & Refrigeration Institute (AHRI)
.1 AHRI 410-2001, Forced-Circulation Air-Cooling And Air-Heating Coils (With Addenda 1, 2 And 3).

.4 Canadian Standards Association Group International (CSA)
.1 CSA C22.2 No. 46-13(R2018) - Electric Air-Heaters.
.2 CSA C22.2 No. 236-15, Heating and Cooling Equipment.

.5 National Electrical Manufacturers Association (NEMA)
.1 NEMA 1-2020 Enclosures for Electrical Equipment.

1.3 SHOP DRAWINGS

.1 Submittals in accordance with Section 23 05 00.

.2 Provide maintenance information in accordance with Section 23 05 00.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Coils shall have the capability to be used in right-hand or left-hand applications.

.2 Each coil shall be selected using a computer selection program approved by AHRI 410.

.3 All duct heaters shall be tested and certified to UL 1996.

2.2 ELECTRIC REHEAT COILS

.1 Cabinet:
.1 The duct heater frame, control enclosure and element support brackets shall be of minimum 0.812mm (20 gauge) galvanized steel.
.2 Provide a large electrical cabinet door hinged for access.

.2 Electrical Connection:
.1 Provide a single point electrical power connection.

.3 Coils:
.1 Coils shall be made of high grade Nickel Chrome alloy (80% nickel and 20% chromium) and shall be insulated by floating ceramic bushings from the galvanized steel frame securely fastened to the element support brackets.
.2 Coil terminal pins shall be stainless steel, mechanically secured and insulated from the frame by a lock which shall keep it floating and stress free.

.4 Clearance
.1 Heaters shall be CSA approved for zero clearance in horizontal ducts.
.2 Coils shall be ETL listed to meet electrical safety standards and shall comply with CSA C22.2 No. 236 and UL 1996 requirements.

.5 Duct Connection
.1 Provide 20mm (¾") flange type construction for connection to the ductwork.

.6 Controls
.1 The controls enclosure shall be NEMA-1 construction with standard door interlocking disconnect switch.
.2 Provide an automatic thermal reset cut out specifically matched to each unit to protect against overheating in case the minimum air flow requirements are not met.
.3 Provide a secondary thermal cut out in the power circuit to provide backup in case of failure of the automatic reset thermal cutout.
.4 Provide a flow switch to confirm positive air flow. If no air flow is present the flow switch shall lock out the electric heat.

.7 Contactors and Fuses
.1 All duct heaters shall be provided with magnetic contactors as required, control transformer, SCR control for full modulation of the electric heating element and air flow sensor.
.2 Provide load fuses in accordance with the National Electric Code.
.3 Terminal blocks and ground lugs will be furnished on all heaters for field wiring. A line voltage to 24 volt, class II transformer shall be provided and mounted inside the control enclosure. All heaters shall have a disconnecting magnetic contactor(s) with a 24-volt holding coil as standard.

.8 Wiring Diagram
.1 A wiring diagram shall be installed on the control box cover.

.9 Testing
.1 Prior to shipment heaters shall be tested in accordance with CSA requirements.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install all coils in accordance to manufacturer’s recommendations and as shown on the drawings.

.2 Provide an access door upstream of all reheat coils

3.2 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Adhere to the latest Canadian Standards Association (CSA International)
.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
.2 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000V.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Safety Data Sheets (SDS).

.3 CSA 22.1 ON-18, Ontario Electrical Safety Code, 27th Edition/2018, and applicable bulletins.

.4 Electrical Safety Authority (ESA) requirements and local applicable codes and regulations.

1.2 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS/GHS/SDS.

.3 Shop drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.
.2 Submit 6 number of copies of drawings and product data to authority having jurisdiction.
.3 If changes are required, notify Departmental Representative of these changes before they are made.

.4 Quality Control: in accordance with Section 01 45 00.
.1 Provide CSA certified equipment and material.
.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
.3 Submit test results of installed electrical systems and instrumentation.
.4 Permits and fees: in accordance with General Conditions of contract. Pay associated fees. Departmental Representative will provide

drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
.5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
.6 Submit certificate of acceptance from Electrical Safety Authority having jurisdiction upon completion of Work to Departmental Representative.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:
.1 In accordance with Section 01 31 19.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within four (4) weeks after Award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.6 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - Submittals.

.2 Factory assemble control panels and component assemblies.

2.2 WARNING SIGNS

.1 Warning signs: in accordance with requirements of authority having jurisdiction.

2.3 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:
.1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, matt white finish face, black core, mechanically attached with self-tapping screws.
.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No." as directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

.10 Receptacles: indicate panel name and circuit number.

2.5 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue

2.7 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

2.8 DISTRIBUTION SYSTEM

.1 120/240V, 1-phase, 3-W, 60 Hz.

.2 Inform other Divisions of electrical system characteristics.

2.9 WIRING SYSTEM

.1 Power and lighting circuits in EMT and/or described in other sections.

.2 Use heavy wall rigid conduit where required by codes.

.3 RW-90, XLPE insulated wire for panel feeder and branch circuits, GTF insulated wire for final fixture connection.

.4 #12 AWG minimum wire size, #10 AWG or larger shall be stranded.

.5 Copper conductors.

.6 Size branch circuits and panel feeders for maximum 2% voltage drop.

.7 Provide insulated green ground conductor in all EMT conduits.

.8 Provide nylon insulated bushings on the ends of all conduits in junction boxes, pullboxes, panelboards, etc.

.9 Minimum size conduit for lighting and power circuits is 21 mm.

2.10 GROUNDING

.1 Ground equipment with approved conductors and connectors.

.2 Make tests required by code and authorities having jurisdiction.

2.11 MOTOR AND CONTROL WIRING

.1 Provide wiring and connections for motors and electrical equipment supplied under other Divisions.

.2 Mechanical Divisions shall wire control circuits 50 volts and under.

2.12 PANELBOARD

.1 Provide panelboard of the circuit breaker type.

.2 Install branch circuit breakers shown on panel schedule.

.3 Panel to be in dead front metal cabinet with hinged door and catches.

.4 Breakers: toggle type, bolt-on, quick-make, quick-break, 40°C ambient temperature compensated and trip-free of operating handles on overloads.

.5 Lock-on handle devices for breakers not controlling lighting. 2P and 3P breakers to be with single handle common trip type.

.6 Typed directory card showing load supplied by each circuit, mounted inside cabinet door. Updated panel directories as required to reflect all work done under this project.

.7 Mount panel at 1500 mm above finished floor with the top of panel not higher than 2000 mm.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Provide two 27 mm spare empty conduits from recessed panels into ceiling space above panel and terminate in an accessible location for any new panel provided under this project.

.10 Panelboards connected to emergency power shall be coloured red.

.11 Enclosures located indoors in climate controlled areas to be typically NEMA 1 rating type and include sprinkler-proof provisions as follows:
.1 where enclosures are surface mounted to include drip shield;
.2 doors and openings to be gasketted;

.3 where equipped with ventilation louvers, louvers designed to prevent penetration of water spray on live parts.

2.13 OUTLET BOXES

.1 Light fixture outlet boxes: standard, octagonal or square as required.

.2 Switch outlet boxes: standard, single or ganged as required.

.3 Receptacle outlet boxes: standard.

.4 Steel construction.

.5 Standard FS conduit fittings for surface mounted outlets in exposed areas.

2.14 SWITCHES

.1 Specification grade, toggle type, 20 amps, 120V back and side wired, chrome plated yoke, silver cadmium oxide contacts, switch mechanism on neoprene cushion.

.2 Locate switches on latch side of door, 1.5 m above finished floor unless noted otherwise.

2.15 RECEPTACLES

.1 Specification grade, 15 amp, 125 volt, AC, 'U' ground parallel blade slots, triple wiping contacts, double grounding terminals, break- off feature for separate feeds, built-in strap in plastic moulded body and back and side wiring terminals.

.2 Locate receptacles 400 mm above finished floor unless noted otherwise.

.3 Provide outlets with various configurations as indicated on electrical drawings.

2.16 COVER PLATES

.1 Common cover plate at ganged outlet boxes. Split plates not allowed.

2.17 FIXTURE MOUNTING

.1 Provide mounting and supports required for safe installation to Departmental Representative's satisfaction.

2.18 LIGHTING FIXTURES

.1 Provide lighting fixtures with lamps as illustrated in electrical standard details.

.2 Shop drawings to consist of catalogue cuts and photometric data from an independent test lab.

2.19 LED FIXTURES

1. LED drivers/Fixtures shall be electronic, labeled as compliant with radio frequency interference (RFI) requirements of FCC title 47 part 15, comply with NEMA SSL 1, have a sound rating of “a” and be rated for a THD of less than 20 percent at all input voltages.
2. Body: minimum 0.952 mm thick o(20 gauge)steel, baked white enamel finish.
3. Lens 100% pure acrylic, low brightness, sparkling crystal prismatic pattern, maximum efficiency and direct glare control. ULC certified.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.20 LAMPS

.1 LED AS SPECIFIED

2.21 DISCONNECT SWITCHES

.1 Heavy duty, quick-make, quick-break.

2.22 WORK IN EXISTING BUILDING

.1 The Work of the specification shall be read in conjunction with and be governed by the requirements with this section.

.2 Maintain life safety systems to all existing buildings at all times during construction.

.3 Maintain electrical continuity to all portions of existing building during all work. Submit letter to Departmental Representative requesting off-hours shut-down. Provide all temporary power and wiring required to achieve this.

2.23 AS-BUILT DRAWINGS

.1 Obtain CAD drawings from Departmental Representative to do CAD as-built drawing.

.2 Submit CAD as-built drawings at the end of the project for review and approval.

.3 Using PWGSC layering system.

2.24 ELECTRICAL COMMISSIONING

.1 Related Sections
.1 This section of the Specification shall be read in conjunction with and be governed by the requirements of other sections.

2.25 SUMMARY OF COMMISSIONING

.1 Commissioning (Cx) is a systematic quality process of ensuring that building systems perform and interact according to the Departmental Representative 's and the Design Engineers' Project Requirements and

contract documents.

.2 Desired Outcomes
.1 A commissioned building provided optimized energy and occupant comfort, and sets the stage for minimal operation and maintenance costs. It serves as a tool for both the Departmental Representative and the Contractor to minimize post-occupancy remedial work.

.3 Commissioning Goals
.1 The Commissioning Process for a project typically focuses on systems and assemblies having to do with the performance objectives meeting the Departmental Representative's Project Requirements (OPR). Contractors, associated Sub-Contractors, equipment and material Suppliers are to support and ensure the requirements for commissioning are met in their respective work.

2.26 DEFINITIONS

.1 Departmental Representative's Project Requirements (OPR)
.1 The documentation of the functional performance requirements of the facility and the Departmental Representative's expectations of how it will be used and operated. This document is analogous to what has traditionally been referred to as the Departmental Representative Program.

.2 Basis of Design (BOD)
.1 A project-specific set of assumptions and design parameters for system and product selections to meet the OPR and applicable regulatory requirements.

.3 Commissioning Agent (CxA)
.1 The CxA facilitates and coordinates the commissioning activities. Involvement of CxA shall not void any guarantees or warranties nor shall it relieve the Contractor of any contractual responsibilites.

.4 Deficiency/Issue
.1 A condition in the installation or function of a component or system that is not in compliance with the construction contract documents and/or Departmental Representative's requirements.

.5 Start-up/Pre-Functional The initial starting or activating of dynamic equipment, including the checkout of components and devices and completing static installation checklists.

.6 Functional Performance Testing (FPT)
.1 Testing performed by the Construction Team to verify that specific components, assemblies, systems, and integrated systems function and perform in accordance with the Departmental Representative's objectives and the contract documents. Tests are generally performed after the Contractor's start-up and initial checkouts are completed.

2.27 COMMISSIONING PLAN

.1 The CxA will develop a Commissioning Plan unique to the project.

.2 The Commissioning Plan identifies the strategies, aspects, and responsibilities within the commissioning process for all project team

members.

.3 The Commissioning Plan contains the following information:
.1 Commissioning Program Overview
.1 Goals and objectives
.2 General project information
.3 Systems to be commissioned.
.2 Commissioning Team
.1 Team members, roles, and responsibilities.
.2 Communication protocol, coordination, meetings, and management.
.3 Commissioning Process Activities
.1 Documenting the Departmental Representative's project requirements.
.2 Preparing the basis of design.
.3 Developing systems functional performance test procedures.
.4 Verifying systems performance.
.5 Reporting deficiencies and the resolution process.
.4 List of systems and assemblies to be commissioned.

.5 The Contractor and the Sub-Contractors shall carryout commissioning activities as per the Commissioning Plan.

2.28 COMMISSIONING DOCUMENTATION

.1 The Commissioning Process includes a significant documentation and paper component. Commissioning documents include but are not limited to:
.1 Drawings and Specifications.
.2 Shop Drawings.
.3 Pre-Functional Check Sheets.
.4 OEM/Contractor Start Up/Test Forms and Records.
.5 As Built Drawings and Specifications.
.6 Functional Performance Test Plans and Results.

PART 3 - EXECUTION

3.1 GENERAL

.1 Turnover all existing equipment that is no longer required to the Departmental Representative. Remove from site any equipment that the Departmental Representative may decide upon. Package all HID fixtures individually.

.2 Protect all removed to be retained equipment from damage. Replace damaged equipment.

.3 Provide temporary power feeder from new electrical room to existing 200A service until permanent feeder is installed.

3.2 COMMISSIONING PROCESS

.1 Commissioning Meetings
.1 Commissioning during the Construction Phase begins with a team kick off meeting, conducted by the CxA, where the Commissioning Plan is reviewed with the Commissioning Team and roles and responsibilities

are clarified. Additional meetings will be held throughout construction, to be conducted by the CxA with the Commissioning Team and if required with other necessary parties attending (for example, a supplier of a product or system), to plan, scope, coordinate, and schedule ongoing commissioning activities and resolve issues/problems. The commissioning meetings will normally be at the call of the CxA in coordination with the Commissioning Team.

.2 Pre-Functional Verification

.1 The Electrical Contractor will develop the Pre-Functional Check Sheets and provide to the Commissioning Agent for review. These pre-functional check sheets are to be completed by the Contractor during their normal installation and start up process.

.2 The equipment start up shall be in accordance with all related specifications and OEM requirements.

.3 Notify the CxA a minimum of two (2) weeks in advance of equipment and system start up and/or installation verification testing. The CxA verifies the Contractor completed check sheets, checks installation and the startup checks/documentation.

.4 Evaluation of the results will be conducted by the CxA. The CxA will evaluate whether the installed systems meet the criteria for the project.

.3 Functional Performance Testing

.1 All Pre-Functional Check sheets and Processes shall be completed and signed off by the CxA prior to starting equipment or system Functional Performance Testing

.2 Systems functional performance testing occurs once all system components are installed, energized, programmed, and otherwise ready for operation.

.4 Testing includes each process in the sequence of operation under central and packaged equipment control.

.5 Systems performance testing relies on the testing procedures developed by the CxA specifically for the systems to be tested.

.6 All equipment/systems shall be functionally tested by the Contractor and Subs prior to demonstration to the CxA. It is the responsibility of the Contractor and Subs to ensure all equipment /systems are functioning properly according to the contract documents before this demonstration occurs.

.7 The Contractor is required to demonstrate functional performance to the CxA, as required by the CxA. The CxA will evaluate whether the system performance meets the criteria set forth by contract documents and the Departmental Representative's project requirements.

.8 Evaluation of the results will be conducted by the CxA. The CxA will evaluate whether the installed systems meet the criteria for the project.

3.3 SYSTEMS TO BE COMMISSIONED

.1 New Lighting and Electrical Distributions/outlets.

.2 Life Safety where required.

3.4 ELECTRICAL CONTRACTOR RESPONSIBILITIES

.1 The Contractor shall be responsible for the commissioning process detailed here and in the Electrical Specifications sections.

.2 The Contractor shall coordinate and cooperate with the other divisions as detailed in the specification sections of the Electrical Specifications.

.3 The Contractor shall only utilize employees with previous experience in testing procedures as they relate to a particular subject.

.4 The Contractor shall hire the Manufacturers' technicians who will conduct tests on their equipment.

.5 Provide a schedule showing commissioning activities and milestones and allow adequate time for testing, commissioning and re-work if required.

.6 Explain and ensure the Sub-Contractors understand commissioning requirements.

.7 Establish and keep separate record of tests, during construction and the post construction phase.

.8 Understand quality standards contained in the specifications and ensure by inspections, review by others and testing that they are being met by the Sub-Contractors.

.9 Arrange samples, test equipment, etc., required by specifications.

.10 Ensure Sub-Contractors' testing is performed and complete prior to turnover.

.11 Develop Pre-Functional Check Sheets.

.12 Completion of Pre-Functional Check Sheets and Functional Performance Test Plans.

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.
.1 Sleeves through concrete: schedule 40 steel pipe, plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32.

.2 Do not install outlets back-to-back in wall; allow minimum [150] mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.
.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.
.1 Local switches: 1400 mm.
.2 Wall receptacles:
.1 General: 300 mm.
.2 Above top of continuous baseboard heater: 200 mm.
.3 Above top of counters or counter splash backs: 175 mm.
.4 In mechanical rooms: 1400 mm.
.3 Panelboards: as required by Code or as indicated.
.4 Telephone and interphone outlets: 300 mm.
.5 Wall mounted telephone and interphone outlets: 1500 mm.
.6 Fire alarm stations: 1500 mm.

.7 Fire alarm bells: 2100 mm.
.8 Television outlets: 300 mm.
.9 Wall mounted speakers: 2100 mm.
.10 Clocks: [2100] mm.
.11 Door bell pushbuttons: 1500 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:
.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00.
.1 Power [generation] [and] [distribution] system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
.5 Systems: fire alarm and communications.
.6 Insulation resistance testing:
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section [01 74 20] [01 35 21].

Commissioning Team Roles and Responsibilities

Commissioning Activities and Milestone’s	OEM (s)	Contractor (s)	Consultants & Designers	Departmental Representative	Commissioning Agent (CxA)
Commissioning Plan		Provide Input Re: Schedule		Reviews	Develop
Briefing Contractors Milestone		Participates		Attends	Briefs
Pre-Functional Check Sheets		Develop/Executes			Reviews
Pre-Functional Inspection (Installation & start-up)		Performs start-up and executes Pre-Functional Check Sheets		Witness as Required	Review installation and start-up execution and documentation
Functional Performance Testing Plan		Assists with development and execution where required.		Witness as Required	Develops test procedures
Functional Performance Testing and verification		Demonstrate operation to CxA		Witness as Required	Witness verify and document results

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 Provide a short-circuit and protective device coordination study for the electrical distribution system. The intent of these studies are to verify that the specified and supplied equipment are properly rated, correctly applied, and within industry and manufacturer's tolerances. Design panel schedules based on the analysis made.

.2 Short circuit study shall:
.1 Include all portions of the electrical distribution system from the normal and alternate sources of power throughout the distribution system down to the smallest protective device.
.2 Consider operation during normal conditions, alternate operations, emergency power conditions, and any other operations which could result in maximum fault conditions.

.3 Coordination study shall:
.1 Determine the correct settings for the protective devices which will minimize the damage caused by an electrical fault and allow for selective coordination between the devices.
.2 Include the closest upstream utility protective device down to the panelboard main, branch, or feeder circuit breakers.
.3 Consider operation during normal conditions, alternate operation, and during emergency power conditions.

1.2 QUALIFICATIONS

.1 Contractor shall have the coordination study prepared by qualified engineers of an independent consultant. Consultant shall be a Registered Professional Electrical Engineer, licensed in the province where the project is completed, who has at least ten (10) years of experience and specializes in performing power system studies.

.2 Perform short circuit and coordination study using the industry recognized program for Windows computer software package.

1.3 SUBMITTALS

.1 Submit power system studies within 30 days after the electrical equipment submittals have been received for review by the Departmental Representative.

.2 Submit three (3) copies of the power systems study.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 IMPEDANCE ONE-LINE DIAGRAM

.1 Create an impedance one-line diagram. Protect all electrical equipment wiring by overcurrent devices installed under this project and indicate each location where the fault current will be calculated. Clearly indicate, on the single-line, the schematic wiring of the electrical distribution system.

.2 Show reference nodes on the single-line diagram referring to a formal report and include the following specific information:
.1 X/R ratios, utility contribution, and short circuit values (asymmetrical and symmetrical) at the bus of the main service, and all downstream equipment containing overcurrent devices.
.2 Transformer kVA and voltage ratings, percent impedance, X/R ratios and wiring connections.
.3 Voltage at each bus.
.4 Identifications of each bus.
.5 Conduit material, feeder sizes and length.

3.2 SHORT CIRCUIT STUDY

.1 Calculate by means of the industry recognized program for Windows computer software package. Incorporate pertinent data, rationale employed, and assumptions in developing the calculations in the introductory remarks of the study.

.2 Do study in accordance with applicable ANSI and IEEE Standards.

.3 Determine available 3 phase short circuit and ground fault currents at each bus. Incorporate motor contribution in determining momentary and interrupting ratings of the protective devices.

.4 Present data determined by short circuit study in table format. Include:
.1 Node & Device identification.
.2 Operating voltage.
.3 Type of Protective device. (i.e. fuse, molded case circuit breaker, etc.)
.4 Device short circuit rating.
.5 Calculated maximum short circuit current, 3 phase or ground fault, asymmetrical and symmetrical, and X/R ratio.
.6 De-rate the devices where the tested X/R ratio is less than the calculated X/R ratio. (maximum fault current multiplied by MF.)
.7 Comments section indicating that device is underrated.

3.3 PROTECTIVE DEVICE COORDINATION STUDY

.1 Calculate by means of the industry recognized program for Windows computer software package.

.2 Meet or exceed CSA C22.1-18 Canadian Electrical Code (CEC) and Ontario Electrical Safety Code 2018 (OESC).

.3 Include the closest upstream utility protective device down to the panelboard main, branch, or feeder circuit breakers. Prepare coordination curves to determine the required settings of protective devices to assure selective coordination.

.4 Include phase and ground overcurrent protection, as well as settings for all other adjustable protective devices.

.5 Graphically illustrate on log-log paper that adequate time separation exists between devices. Use sufficient curves to clearly indicate the coordination achieved between devices. Maintain reasonable coordination intervals and separation of characteristic curves. Plot the specific time-current characteristics of each protective device in such a manner that the upstream devices will be clearly depicted on the sheet.

.6 Plots shall include complete titles, representative one-line diagram and legends, associated power company's relays or fuse characteristics, and complete parameters of transformers. Maximum of eight protective devices per sheet.

.7 Indicate the following specific information on the coordination curves:
.1 Device identifications.
.2 Time and current ratio for curves.
.3 Fuse circuit breaker, and relay curves, showing complete operating bands of low-voltage circuit breaker trip curves.
.4 Significant maximum symmetrical or asymmetrical short circuit cutoff point.
.5 Electric utility's relays and/or fuses including manufacturer's minimum melt, total clearing, tolerance.
.6 Medium voltage equipment relays.
.7 Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
.8 Low voltage equipment circuit breaker trip devices, including manufacturers tolerance bands.
.9 Pertinent transformer full-load currents at 100% and 600%.
.10 Ground fault protective device settings.
.11 Other system load protective devices for largest branch circuit and feeder circuit breaker in each motor control center and panelboard.

.8 Develop a table to summarize the settings selected for the protective devices. Include the following:
.1 Device identification.
.2 Current transformer ratio, relay tap, time delay, and instantaneous pickup.
.3 Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
.4 Fuse rating and type.
.5 Ground fault pickup and time delay.

3.4 ANALYSIS

.1 Analyze short circuit calculations and highlight any equipment that is determined to be underrated as specified or not coordinated. Propose approaches to effectively protect the underrated equipment. Proposed major corrective modifications will be taken under advisement by the Departmental Representative, and the Contractor will be given further instructions.

.2 After developing the coordination curves, highlight areas lacking coordination. For each sheet, present a technical evaluation with a discussion of the logical compromises for best coordination.

3.5 REPORT

.1 Summarize the results of the power system study in a final report.

.2 Report shall include the following sections:

.1 Introduction, executive summary and recommendations, assumptions, impedance one line drawing, and copies of the project single-line drawings.

.2 Tabulations of equipment ratings versus calculated short circuit values and X/R ratios, and commentary regarding same.

.3 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

.4 Copies of manufacturer's time current curves for the devices studied and plotted.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No. 131-17, Type TECK 90 Cable.
.2 CAN/CSA-C61089-11(R2020), Round Wire Concentric Lay Overhead Electrical Stranded Conductors.

.2 National Electrical Manufacturers' Association (NEMA)/Insulated Cable Engineers Association (ICEA)
.1 ANCI/NEMA WC 74/ICEA S-93-2017, 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Provide product data in accordance with Section 01 33 00.
.1 Provide manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Quality assurance submittals: submit following in accordance with Section 01 45 00.
.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 PRIMARY OVERHEAD CONDUCTORS (1001 - 5000 V)

.1 Bare aluminum conductors steel reinforced: to CAN/CSA-C61089, size as indicated.

2.2 RUBBER INSULATED CABLES (1001 - 5000 V)

.1 Conductors: aluminum size as indicated.

.2 Insulation: cross-linked polyethylene compound rated RL90.

.3 Insulation shielding: semi-conducting non-metallic tape over insulation, and served wire shield over tape.

.4 Cable jacket: thermosetting with separator tape between shield and jacket.

2.3 ALUMINUM SHEATHED CABLES (1001 - 5000 V)

.1 Sheath: seamless, corrugated, aluminum.

.2 Outer covering: extruded PVC.

2.4 CONCENTRIC NEUTRAL POWER CABLE (1001 - 5000 V)

.1 Single copper conductor, size as indicated.
.1 Semi-conducting strand shield.

.2 Insulation: cross-linked polyethylene rated 90 degrees C and 5 kV.

.3 Semi-conducting insulation shielding layer.

.4 Copper neutral wires applied helically over insulation shield equivalent to 100% full capacity.

.5 Separator mylar tape over neutral wires.

.6 Extruded PVC jacket rated minus 40 degrees C.

2.5 PRIMARY OVERHEAD CONDUCTORS (5001 - 15000 V)

.1 Bare, aluminum, steel reinforced conductors, size as indicated.

2.6 RUBBER INSULATED CABLES (5001 - 15000 V)

.1 Single aluminum conductor: to ANCI/NEMA WC 74/ICEA S-93-639 size as indicated.

.2 Strand shielding.

.3 Insulation: chemically cross-linked thermosetting polyethylene material rated 90 degrees C and 15 kV.

.4 Barrier tape over shield.

.5 Overall jacket of PVC rated minus 40 degrees C.

2.7 CONCENTRIC NEUTRAL POWER CABLES (5001 - 2.8 00 V)

.1 Concentric neutral power cable: to ANCI/NEMA WC 74/ICEA S-93-639.

.2 Single aluminum conductor, size as indicated.

.3 Semi-conducting strand shield.

.4 Class 2.

.5 Insulation: cross-linked thermosetting polyethylene material rated 90°C and 15kV for 133% voltage level.

.6 Semi-conducting insulation shielding layer.

.7 Copper neutral wires applied helically over insulation shield equivalent to 100% full capacity.

.8 Separator tape over neutral wires.

.9 Extruded PVC jacket rated minus 40°C.

2.8 TECK POWER CABLE (1001 - 15000 V)

.1 Cable: to CSA C22.2 No. 131 in accordance with Section 26 05 00.

.2 Bare aluminum grounding conductor, size as indicated.

.3 Aluminum circuit conductors, size and number as indicated.

.4 Strand shielding.

.5 Insulation: chemically cross-linked thermosetting polyethylene rated RW90 5 kV to ANCI/NEMA WC 74/ICEA S-93-639.

.6 Insulation shielding: semi-conducting non-metallic tape over insulation and served wire shield over tape to ANCI/NEMA WC 74/ICEA S-93-639.

.7 Separator tape over conductor assembly.

.8 Inner jacket of PVC.

.9 Interlocked aluminum armour.

.10 Overall PVC jacket rated minus 40°C.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install power cable on pole lines as indicated and in accordance with manufacturer's instructions.

.2 Install power cable in trenches as indicated.

.3 Provide supports and accessories for installation of high voltage power cable.

.4 Install stress cones, terminations and splices in accordance with manufacturer's instructions

.5 Install grounding in accordance with local inspection authority having jurisdiction.

.6 Provide cable identification tags and identify each phase conductor of power cable.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Use of qualified tradespersons for installation, splicing, termination and testing of high voltage power cables.

.3 Engage an independent testing agent to test high voltage power cable. Submit test result and inspection certificate.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CAN/CSA C22.2 No.18.2-06(R2016), Outlet Boxes, Conduit Boxes and Fittings.
.2 CAN/CSA-C22.2 No.65-18, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE).

.2 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to 1Y-2 to consist of:
.1 Connector body and stud clamp for stranded copper conductors.
.2 Clamp for stranded copper conductors.
.3 Stud clamp bolts.
.4 Bolts for copper conductors.
.5 Sized for conductors as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:
.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
.3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65 Replace insulating cap.
.4 Install bushing stud connectors in accordance with 1Y-2.

3.3 CLEANING

.1 Progress Cleaning:
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 20.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Provide product data in accordance with Section 01 33 00.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
.1 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90, Non-Jacketted.
.2 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon rated at 600 V.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Type: ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.

.5 Connectors: anti short connectors.

2.3 CONTROL CABLES

.1 Type: LVT: soft annealed copper conductors, sized as indicated:
.1 Insulation: thermoplastic.
.2 Sheath : armour of closely wound aluminum wire.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: soft annealed copper conductors, sized as indicated:
.1 Insulation: TWH.
.2 Shielding: tape coated with paramagnetic material over each conductors.
.3 Overall covering: polyethylene jackets.

.3 Type: 600 V stranded annealed copper conductors, sizes as indicated:
.1 Insulation: RW90.
.2 Shielding: magnetic tape conductors.
.3 Overall covering: thermoplastic jacket.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 01 91 00.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20.

.2 Cable Colour Coding: to Section 26 05 00.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
  .1 In conduit systems in accordance with Section 26 05 34.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 Section 26 05 32 - Outlet, Boxes, Conduit Boxes and Fittings.

1.3 REFERENCES

.1 Canadian Standards Association
  .1 CSA C22.2 No.41-13(R2017), Grounding and Bonding Equipment.
  .2 CAN/CSA C22.2 No.65-18 Wire Connectors.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CAN/CSA-C22.2 No.65 as required sized for conductors.

.2 Junction boxes with respective pothead for conductor cables in accordance with Section 26 05 31.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Bond and ground as required to CSA-C22.2 No.41.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Quality assurance submittals: provide in accordance with Section 01 45 00.
.1 Manufacturer's Instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Rod electrodes: copper clad steel, 19 mm diameter by 3 m long.

.2 Conductors: bare, stranded, untinned soft annealed copper wire, size No. 4/0 AWG and 2/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.

.3 Conductors: bare, stranded untinned soft annealed copper wire, size No. 4 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.

.4 Conductors: PVC insulated coloured green, stranded untinned soft annealed copper wire No. 10 AWG for grounding meter and relay cases.

.5 Conductors: No. 3/0 AWG extra flexible (425 strands) copper conductor for connection of switch mechanism operating rod to gradient control mat, fence gates, vault doors.

.6 Bolted removable test links.

.7 Accessories: non-corroding, necessary for complete grounding system, type, size material as indicated, including:
.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

.8 Wire connectors and terminations: as indicated.

.9 Grounding resistance bank: outdoor, 1-phase, star connected, 5 ohms, 400A, 240V, metallic type.

.10 Zig-zag grounding transformer: outdoor, 1-phase, star connected, 100kVA, 240V, iron core.

.11 Cable sheath isolating sleeves.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of local authority having jurisdiction.

.2 Ground fences to grounding system independent of station ground.

.3 Install connectors and cadweld in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors during and after construction.

.5 Make buried connections, and connections to electrodes, structural steel work, using permanent mechanical connectors to IEEE 837.
.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Use No. 4/0 AWG bare copper cable for main ground bus of substation and No. 2/0 AWG mhd bare copper cable for taps on risers from main ground bus to equipment.

.8 Use untinned copper conductors for aluminum structures.

.9 Do not use bare copper conductors near un-jacketed lead sheath cables.

.10 Install grounding resistor bank.

.11 Install zig-zag grounding transformer.

3.2 ELECTRODE INSTALLATION

.1 Install ground rod electrodes. Make grounding connections to station equipment.

.2 Install ground rod electrodes at transformer and switchgear locations.

.3 Install gradient control mats. Connect mats to station ground electrode and switch mechanism operating rods.

.4 Make special provision for installing electrodes that will give

acceptable resistance to ground value, where rock or sand terrain prevails.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections as indicated to typical station equipment including: metallic water main, line sky wire, neutral, gradient control mats. Non-current carrying parts of: transformers, generators, motors, circuit breakers, reclosers, current transformers, frames of gang-operated switches and fuse cutout bases. Cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers. Meter and relay cases. Any exposed building metal, within or forming part of station enclosure. Sub-station fences, pothead bodies. Outdoor lighting.

.2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

.3 Connect metallic piping (water, oil, air, etc.) inside station to main ground bus at several locations, including each service location within station. Make connections to metallic water pipes outside station to assist in reduction of station ground resistance value.

3.4 NEUTRAL GROUNDING

.1 Connect transformer neutral and distribution neutral together using 1000 V insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground. Ensure distribution neutral and neutrals of potential transformers and service banks are bonded directly to transformer neutral and not to main station ground.

.2 Interconnect electrodes and neutrals at each grounding installation.

.3 Connect neutral of station service transformer to main neutral bus with tap of same size as secondary neutral.

.4 Ground transformer tank with continuous conductor from tank ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer to primary neutral in same manner.

3.5 POLE MOUNTED SWITCHING DEVICE GROUNDING

.1 Drive four ground rods 3 m long at base of each pole on which group-operated line switching devices are mounted.

.2 Arrange rods in square formation with 3 m sides, located so that operator must stand within square to operate switch.

.3 Interconnect ground rods with No. 2/0 AWG stranded annealed copper conductor and join to switch operating handle ground wires.

.4 Connect operating handle of switch to handle base with No. 3/0 AWG extra flexible copper conductor.

3.6 POLE MOUNTED TRANSFORMER GROUNDING

.1 Drive ground rods at base of each pole on which transformers are mounted and interconnect transformer, system neutral, lightning arresters and ground rods.

3.7 GROUNDING IN PERMAFROST

.1 Install system and equipment grounding in permafrost area in accordance with Section 26 05 28.

3.8 CABLE SHEATH GROUNDING

.1 Bond single conductor, metallic sheathed cables together at one end only.

.2 Use No. 6 AWG flexible copper wire soldered, not clamped, to cable sheath.

.3 Connect bonded cables to ground with No. 2/0 AWG copper conductor.

3.9 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Engage an independent testing agent to inspect grounding and perform ground resistance test before backfill.

.3 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction.

.4 Perform test before energizing electrical system.

.5 Provide step-and-touch potential calculations using measured station ground resistance measurements. Submit test result and inspection certificate before energizing electrical system.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00.

1.2 REFERENCES

.1 Institute of Electrical and Electronics EngineersIEEE
.1 IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect grounding equipment.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Grounding conductors: bare stranded copper, soft annealed, size as required.

.3 Insulated grounding conductors: green, copper conductors, size as required.

.4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Provide new grounding where required and connect to existing grounding system.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at both one ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.8 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Frames of motors, starters, control panels, panels.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with IEE 837 Section 26 05 00.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole malleable iron steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-2018, Canadian Electrical Code, Part 1.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat edge covers.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00.

.2 Identification Labels: Size 2 nameplate.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-2018, Canadian Electrical Code, Part 1, 24th Edition.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Submit samples for floor box in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi-gang flush device boxes for flush installation, minimum size 76x50x38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished walls.

2.3 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 FITTINGS – GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.40-M2017 (R2017), Junction and Pull Boxes.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for raceway and boxes and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for raceway and boxes for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect raceway and boxes from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 JUNCTION BOXES POWER LEVEL

.1 Cast iron octagonal box painted with chromate primer and gray enamel with joints ground smooth and fitted with gasket, contacts mounted on porcelain supports to which conductors are fastened by soldered-on lugs, medium hard asphalt compound filled, suitable for 3 phase, 15 kV cable, 250 MCM maximum cable size, with wiping sleeve stuffing box entrance.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for raceway and boxes installation in accordance with manufacturer's

written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install junctions boxes on trench floor around cable splice to CSA C22.2 No.40. Connect cable terminals to box contacts.
.1 Ground junction boxes as required.
.2 Fasten lid securely and check for air leaks before trench is backfilled.

.2 Install distribution level steel boxes on walls of maintenance holes tunnels. Splice main cable in box and connect branch feeder. Fasten cover and fill with compound.
.1 Ground steel boxes as required.

.3 Install power level boxes as follows:
.1 Cast iron type: on trench floor, connect cable terminals to box contacts, fasten lid and fill with compound before trench is backfilled.
.3 Ground power level boxes as required.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No. 18.2-06(R2016), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
.2 CAN/CSA-C22.2 NO. 18.1-13(R2018), Metallic Outlet Boxes.
.3 CAN/CSA-C22.2 No. 18.3-12(R2017), Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
.4 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.5 CSA C22.2 No. 83-M1985(R2017), Electrical Metallic Tubing.
.6 CSA C22.2 No. 83.1-07(R2017), Electrical Metallic Tubing - Steel.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
.1 Submit cable manufacturing data.

.3 Quality assurance submittals:
.1 Test reports: submit certified test reports.
.2 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.1, with couplings.

.2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 53 mm and smaller.
.1 Two hole steel straps for conduits larger than 53 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 3 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 27 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.
.1 Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Surface mount conduits on existing concrete wall and columns.

.4 Use rigid galvanized steel threaded conduit except where specified otherwise.

.5 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical damages.

.6 Use flexible metal conduit for connection to motors in dry areas connection to recessed fixtures without prewired outlet box connection to recessed fluorescent fixtures, work in movable metal partitions.

.7 Use liquid tight flexible metal conduit for connection to motors or

vibrating equipment in damp, wet or corrosive locations.

.8 Install conduit sealing fittings in hazardous areas.
.1 Fill with compound.

.9 Minimum conduit size for lighting and power circuits: 21 mm.

.10 Bend conduit cold:
.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 21 mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Run 2-27 mm spare conduits up to ceiling space and 2-27 mm spare conduits down to ceiling space from each flush panel.
.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.15 Remove and replace blocked conduit sections.
.1 Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.26-13(R2018), Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wireways and auxiliary gutters and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for wireways and auxiliary gutters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect.
.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22.2 No.26.

.2 Sheet steel with cover to give uninterrupted access.

.3 Finish: baked grey enamel in accordance with Section 26 05 00.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wireways and auxiliary gutters installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install wireways and auxiliary gutters in accordance with manufacturer's written recommendations.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

.6 Ground metallic wireways and gutters as required.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
  .1 CAN/CSA-Z809-16, Sustainable Forest Management.

.2 Forest Stewardship Council (FSC)
  .1 FSC-STD-CAN-1-2018 V1-0 EN FSC National Forest Stewardship Standard of Canada

.3 Insulated Cable Engineers Association, Inc. (ICEA)

.4 Sustainable Forestry Initiative (SFI)
  .1 SFI-2015-2019 Standard.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
  .1 Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
  .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  .2 Store and protect cables from nicks, scratches, and blemishes.
  .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 CABLE PROTECTION

.1 38 x 140 mm planks pressure treated with clear coloured, or copper naphthenate or 5% pentachlorophenol solution, water repellent

preservative.

2.2 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

.2 Cedar post type markers: to CAN/CSA-Z809 or FSC or SFI 89 x 89 mm, 1.5 m long, pressure treated with clear coloured, or copper napthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.
.1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 DIRECT BURIAL OF CABLES

.1 After sand bed in accordance with Section 31 23 33.01, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable.
.1 Do not pull cable into trench.

.2 Include offsets for thermal action and minor earth movements.
.1 Offset cables 150 mm minimum for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Make termination and splice only as indicated leaving 0.6 m minimum of surplus cable in each direction.
.1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.

.4 Underground cable splices not acceptable.

.5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables,

12 times diameter of cables or in accordance with manufacturer's instructions.

.6 Cable separation:
.1 Maintain 75 mm minimum separation between cables of different circuits.
.2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.
.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
.5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
.6 Install treated planks on lower cables 0.6 m minimum in each direction at crossings.

.7 After sand protective cover specified in Section 31 23 33.01, is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks interlocking cable blocks as indicated to cover length of run.

3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.4 MARKERS

.1 Mark cable every 150 m along cable duct runs and changes in direction.

.2 Mark underground splices.

.3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.4 Install concrete cable markers within 180 m from each side of runway centreline; 45 m from each side of taxi way centreline; 50 m from edge of taxi ramps or aprons.

.5 Install cedar post type markers.

.6 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Perform tests using qualified personnel.
.1 Include necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds.
.1 Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests:
.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests:
.1 Ensure that terminations and accessory equipment are disconnected.
.2 Ground shields, ground wires, metallic armour and conductors not under test.
.3 High Potential (Hipot) Testing.
.1 Conduct hipot testing at% of original factory test voltage in accordance with manufacturer's ICEA recommendations.
.4 Leakage Current Testing:
.1 Raise voltage in steps from zero to maximum values as specified by ICEA manufacturer for type of cable being tested.
.2 Hold maximum voltage fors specified time period by ICEA manufacturer.
.3 Record leakage current at each step.

.7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.6 CLEANING

.1 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)
.1 LEED Canada For New Construction and Major Renovations 2009.
.2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.2 CSA International
.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (27th Edition), Safety Standard for Electrical Installations.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for photoelectric devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect photoelectric devices from nicks, scratches, and blemishes.
.3 Protect metal accessories and trim from being bent or damaged.
.4 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 PHOTOELECTRIC LIGHTING CONTROL

.1 Photoelectric Lighting Controls: to CSA C22.1.
- .1 Luminaire mounting.
- .2 Capable of switching 1000W of lighting at 120V.
- .3 Voltage variation: plus or minus 10%.
- .4 Temperature range: minus 40 degrees C to plus 40 degrees C.
- .5 Switching on lights at 10lx.
- .6 Switching off lights at 500lx.
- .7 Rated for 5000 operations.
- .8 Options:
  - .1 Lightning arrester.
  - .2 Fail-safe circuit completed when relay de-energized.
  - .3 Twist-lock type receptacle.
  - .4 Terminal strip.
  - .5 Sensitivity adjustment.
- .9 Switching time delay of 30 s.
- .10 Wall mounting bracket.
- .11 Colour coded leads: size 10 AWG, 460 mm long.

2.2 CONTACTOR

.1 Contactor: to CSA C22.1.
- .1 Cabinet mounting.
- .2 Capable of switching multiple lamp circuits with total lighting load of 6000W.
- .3 Waterproof enclosure.
- .4 Manual override.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for lighting control device installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install photoelectric controls in accordance with manufacturer's written instructions and to CSA C22.1.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
  .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
  .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by lighting control devices installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
  .1 CSA C9-17, Dry-Type Transformers.
  .2 CAN/CSA-C802.2-18, Minimum Efficiency Values for Dry Type Transformers.
  .3 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  .1 EEMAC GL1-3-1988, Transformer and Reactor Bushings.

.3 National Electrical Manufacturers Association (NEMA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
  .1 Submit manufacturer's instructions, printed product literature and data sheets for transformers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
  .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  .2 Indicate on drawings:
    .1 Dimensions showing enclosure, mounting devices, terminals, taps, internal and external component layout.
    .2 Technical data:
      .1 kVA rating.
      .2 Primary and secondary voltages.
      .3 Frequency.
      .4 Single Three phase.
      .5 Polarity or angular displacement.
      .6 Full load efficiency.
      .7 Regulation at unity pf.
      .8 BIL.
      .9 Insulation type.
      .10 Sound rating.

.4 Sustainable Design Submittals:
  .1 Construction Waste Management:
    .1 Submit project Waste Management Plan Waste Reduction Workplan highlighting recycling and salvage requirements.
    .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.5 Factory Test Submittals:submit standard factory test certificates of each transformer and type test of each transformer in accordance with CSA C9.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.
.2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

.3 Operation and maintenance instructions to include:
.1 Tap changing.
.2 Recommended environmental conditions.
.3 Recommended periodic inspection and maintenance.
.4 Bushing replacement.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect transformers from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.
.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacture of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 20.

1.6 EXTRA MATERIALS

.1 Supply maintenance materials in accordance with Section 01 78 00.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Dry-type transformers: to CSA C9.

.2 Bushings: to EEMAC GL1-3.

2.2 TRANSFORMER CHARACTERISTICS

.1 Type: ANN.

.2 Rating: 75kVA, 1 phase,60 Hz.

.3 105 insulation system class, 150 degrees C temperature rise.

.4 Impedance: 5% standard.

.5 Primary winding: 2.4kV, delta, BIL 30kV and with neutral brought out ungrounded.

.6 Secondary winding: 240V, delta, BIL 10kV, three-wire with neutral brought out and high low resistance effectively grounded ungrounded.

.7 No load losses not to exceed 5% of kVA rating.

.8 Full load losses not to exceed 1.3% of kVA rating.

.9 No load and full load losses to exceed those indicated in CAN/CSA-C802.2.

2.3 ENCLOSURE

.1 Fabricated from sheet steel with drip shield.

.2 Bolted hinged removable panels for access to tap connections, enclosed terminals.

.3 Conductor entry:
- .1 Knockouts.
- .2 Potheads.
- .3 Junction boxes.
- .4 Bushings.
- .5 Clamping rings.
- .6 Entry for cable.

.4 Designed for floor mounting.

.5 Indoor, ventilated, self-forced air cooled type. Temperature of exposed metal parts not to exceed 65 degrees C rise.

.6 Outdoor, ventilated, self-cooled type, CSA 3 enclosure.

.7 Pad mounted type:
- .1 Include conductor entry through bottom for underground distribution, with separate high and low voltage compartments divided by full length metal barrier.
- .2 Ensure each compartment includes access door with concealed hinges.
- .3 Secondary door to have 3-point latch, external operating handle, provision for padlocking and arranged so that secondary door must be open before access gained to primary compartment.

.8 Open type: no enclosure, for installation in switchgear enclosure.

2.4 VOLTAGE TAPS

.1 Standard 5 taps, 1 at nominal voltage, 2 at 2.5% intervals above nominal, 2 at 2.5% intervals below nominal.

2.5 TAP CHANGER

.1 Bolted-link type.

2.6 WINDINGS

.1 Primary and secondary coils:
.1 Copper.
.2 Vacuum cast epoxy.

.2 Coil and core assembly:
.1 Taps located at front of coils for accessibility.

.3 Sound level: not to exceed 50dB.

2.7 ACCESSORIES

.1 Wiring and terminal box for protective devices.

.2 Digital type winding temperature indicator with sequence 3 required.

.3 Grounding terminal: inside of enclosure.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Equipment labels: nameplate size 7, labelled.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for transformers installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Locate, install and ground transformers in accordance with manufacturer's instructions.

.2 Set and secure transformers in place, rigid plumb and square.

.3 Connect primary terminals to high voltage circuit.

.4 Connect secondary terminals to secondary feeder cable.

.5 Use flexible conduit to make connections to transformer.

.6 Energize transformers and check secondary no-load voltage.

.7 Adjust primary taps as necessary to produce rated secondary voltage

at no-load.

.8 Wire one set of contacts on winding temperature detector relay to sound alarm, wire second set of contacts to trip transformer circuit interrupter.

.9 Wire alarm contacts on winding temperature indicator to sound alarm when excessive temperature reached.

.10 Locate and install cooling fans.
.1 Connect thermostat control.
.2 Connect sequence contacts of temperature indicator:
.1 First contact closure: start fan.
.2 Second contact closure: sound alarm.
.3 Third contact closure: trip secondary breaker.

.11 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.

.12 Check transformer for dryness before putting it into service and if it has not been energized for some considerable time.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Energize transformers and apply incremental loads:
.1 0% for 4 hours.
.2 10% for next 1 hour.
.3 25% for next 2 hours.
.4 50% for next 3 hours.
.5 Full load.
.6 At each load change, check temperatures ambient enclosure ventilating air winding.
.7 Adjust cooling fan controls if required.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.
.2 Repair damage to adjacent materials caused by transformers installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.193-M1983(R2014), High-Voltage Full-Load Interrupter Switches.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for interrupter switches and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:
.1 Construction Waste Management:
.1 Submit project Waste Management Plan Waste Reduction Workplan highlighting recycling and salvage requirements.
.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for interrupter switches for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect interrupter switches from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in

Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 LOAD INTERRUPTER SWITCH

.1 Load Interrupter Switch: to CSA C22.2 No.193.

.2 3 pole, quick-make, quick-break assembly, stored energy operating mechanism manual operated, assembled on welded steel base.

.3 Continuous full load rating: 600A, interrupting rating: 270MVA, symmetrical at 5kV.

.4 Voltage rating: 5 kV.

.5 60kV BIL.

.6 Interphase barriers.

.7 Non-removable operating handle c/w provision for pad locking key interlock.

.8 Power fuses: A maximum.

.9 Enclosure: CSA Enclosure.

.10 Include viewing windows that permits full view of the position of all three switch blades.

.11 Interlocks with features as follow:
.1 Fuse is only accessible after switch is opened.
.2 Switch can be closed only after fuse access door is closed.

2.2 FABRICATION

.1 Factory assemble and adjust 3 pole gang operated switch, operating assembly, interphase barriers and interlocks.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for interrupter switches installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions

have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install load interrupter switches.

.2 Check switch contact resistance with low resistance meter.

.3 Megger switch across each pole, from pole to pole, and from pole to ground.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA Group
.1 CSA C22.2 No.31-18, Switchgear Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for service entrance board and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate on drawings:
.1 Floor anchoring method and foundation template.
.2 Dimensioned cable entry and exit locations.
.3 Dimensioned position and size of bus.
.4 Overall length, height and depth.
.5 Dimensioned layout of internal and front panel mounted components.
.3 Include time-current characteristic curves for circuit breakers and fuses.

.4 Test and Evaluation Reports:
.1 Submit six (6) copies of certified test results.

.5 Sustainable Design Submittals:
.1 Construction Waste Management:
.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:
.1 Submit maintenance materials in accordance with Section 01 78 00.

.2 Provide:
.1 3 extra fuses for each type above 600 A.
.2 6 extra fuses for each type up to and including 600 A.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for service entrance board for incorporation into manual.

.3 Submit six (6) copies of operation and maintenance manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect service entrance board from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE BOARD

.1 Service Entrance Board: to CSA C22.2 No.31.

.2 Rating: 240V, 1-phase, 3-wire, 400A, short circuit current 42kA (rms symmetrical).

.3 Cubicles: wall-mounted, free standing, dead front, size as indicated.

.4 Barrier metering section from adjoining Sections.

.5 Provision for installation of power supply authority metering in barriered Section.

.6 Departmental Representative metering.

.7 Distribution section.

.8 Hinged access panels with captive knurled thumb screws.

.9 Bus bars and main connections: 99.3% copper aluminum.

.10 Bus from load terminals of main breaker disconnect switch via metering

section to main lugs of distribution section.

.11 Cable from load terminals of main breaker disconnect switch to metering section and cable bus from metering section to lugs of distribution section.

.12 Identify phases with colour coding.

2.2 MOULDED CASE CIRCUIT BREAKERS

.1 The main circuit breaker shall be of a high capacity insulated case type with frame size as noted on the drawings with minimum interrupting capacity of 42KA symmetrical rms amps at 600 volts. The breaker shall be fixed mounting, manually operated with stored energy mechanism to give quick make and quick breaker action and must have a manual push button trip.

.2 The circuit breakers shall have solid state current control unit designed to function with the published characteristic curves for single phase and 3 phase balanced loads and all arrangements of unbalanced loads. It shall contain long time pick up, short time delay, instantaneous and ground fault elements. These elements shall operate independently. The long time, short time and ground fault elements shall each have field adjustable time bands with all calibrated points being set by selector switches on the face plate. A trip indicator shall be included to show the type of fault that cause the breaker to trip. The control unit shall derive its power from an internally mounted current sensor and no external power supply shall be needed to trip the breaker.

2.4 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end for size grounding cable.

2.5 GROUND FAULT UNIT

.1 The ground fault protection shall be an integral part of the main breaker and no separate power supply shall be required..

2.6 POWER SUPPLY AUTHORITY METERING

.1 Separate cubicle compartment and metal raceway for exclusive use of power supply authority metering.

.2 Mounting accessories and wiring for metering supplied by power supply authority:
.1 potential transformers.
.2 current transformers.
.3 Watthour meter.
.4 Demand meter with kWh register.

2.7 FINISHES

.1 Apply finishes in accordance with Section 26 05 00.

.1 Service entrance board exterior: gray.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Nameplates:
.1 White plate, black letters, size 7.
.2 Complete board labelled: "120/240V."
.3 Main disconnect labelled: "Main Breaker Switch".
.4 Branch disconnects labelled: "Feeder No . 1", "Feeder No. 2", as indicated.
.5 Metering compartment labelled: “Utility Metering”.

2.9 SOURCE QUALITY CONTROL

.1 Departmental Representative to witness final factory tests.

.2 Notify Departmental Representative in writing 5 days in advance that service entrance board is ready for testing.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for service entrance board installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION00

.1 Locate service entrance board and fasten to wall.

.2 Connect main secondary service to line terminals of main breaker disconnect switch.

.3 Connect load terminals of distribution breaker's switches to feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run one grounding conductor 4/0 AWG bare copper in 27 mm conduit from ground bus to building ground.

.6 Check trip unit settings and fuse sizes against co-ordination study to ensure proper working and protection of components.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74.00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74.00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.29-15(R2019),Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Include on drawings:
.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect panelboards from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
.1 Install circuit breakers in panelboards before shipment.
.2 In addition to CSA requirements manufacturer's nameplate must

show fault current that panel including breakers has been built to withstand.

.2 250V panelboards: bus and breakers rated for 42kA (symmetrical) interrupting capacity or as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Aluminum bus with neutral of same ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel as per colour schedule.

.11 Isolated ground bus.

.12 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

.5 Lock-on devices for receptacles, fire alarm, emergency, door supervisory, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Nameplate for each panelboard Size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards Size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

.5 Circuits supplying Patient Care Areas must be entered in circuit directory with Bold Font.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Where panels of different systems (i.e. Standard and Vital Power) supply a common patient care area, ground busses in panels to be interconnect with a minimum #6 AWG ground conductor.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of

materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.94.1-15, Enclosures for Electrical Equipment, Non Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA 250-2014, Enclosures for Electrical Equipment (1000 Volts Maximum).

.3 The Munsell System of Colour Notation

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.1 Indicate on drawings.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 20.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CSA C22.2 No. 94.1, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Equip enclosure with hot dipped galvanized mounting rails 1m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.
.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

.8 Enclosure construction such as to allow configuration of single or ganged enclosures.

.9 Enclosure capable of being shipped in knocked-down condition.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.42-10(R2020), General Use Receptacles, Attachment Plugs and Similar Devices.
.2 CSA C22.2 No.42.1-13(R2017), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
.3 CSA C22.2 No.55-15, Special Use Switches.
.4 CAN/CSA C22.2 No. 111-18, General Use Snap Switches

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect wiring devices from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 SWITCHES

.1 15A, 120V, single pole, double pole, three-way, switches to: CSA C22.2 No.55 and CAN/CSA C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:
.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine moulding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory on drywall and Brown on existing concrete walls toggle.

.3 Toggle operated fully rated for tungsten filament, LED, and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
.1 Ivory urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
.1 Ivory in drywalls and Brown in concrete walls urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Finishes to be confirmed prior to ordering.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.4 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Switches:
.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height in accordance with Section 26 05 00.

.2 Receptacles:
.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
.2 Mount receptacles at height in accordance with Section 26 05 00.
.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
.4 Install GFI type receptacles as indicated.

.3 Cover plates:
.1 Install suitable common cover plates where wiring devices are grouped.
.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
.3 Provide outdoor WP coverplates to meet ESA requirements.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74.00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74.00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

PART 1 - GENERAL

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide fuse performance data characteristics for each fuse type and size above 30A. Performance data to include: average melting time-current characteristics.

.3 Shop Drawings:
.1 Provide shop drawings in accordance with Section 01 33 00.
.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in moisture free location.

.4 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 Three spare fuses of each type and size installed above 600 A.

.3 Six spare fuses of each type and size installed up to and including 600A.

PART 2 - PRODUCTS

2.1 FUSES - GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

.1 Class L fuses.
.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
.2 Type L2, fast acting.

.2 Class J fuses.
.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
.2 Type J2, fast acting.

.3 Class R -R fuses.
.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.4 Class C fuses.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.
.1 Install rejection clips for Class R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.5 Install spare fuses in fuse storage cabinet.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International (CSA)
.1 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2016).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store circuit breakers in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect circuit breakers.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and ground-fault circuit-interrupters: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 ENCLOSURE

.1 Sprinkler-proof: NEMA 1R.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as required.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

_

PART 1 - GENERAL

1.1 CANADIAN STANDARDS ASSOCIATION (CSA).

.1 CAN/CSA-C222.2#144-M91(R2015)Ground Fault Circuit-interrupters

.2 CAN/CSA-C222.2#144.1-16Ground Fault Circuit-interrupters (TriNational Standard with UL 943 and NMX-J-520-ANCE

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results for Electrical.

.2 Section 26 24 16.01 – Panelboards Breaker Type.

.3 Section 26 28 16.02 – Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 The specified transient surge protective equipment shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

.2 Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41, C62.45).

.3 American National Standards Institute.

.4 Federal Information Processing Standards Publication 94 (FIPS PUB 94).

.5 Underwriters Laboratories UL 1283 5th Edition and UL 1449 – 3rd Edition.

.6 Underwriters Laboratories Canada (ULC).

.7 Ontario Hydro Electrical Safety Code 2018

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittals.

.2 Provide verification that the SPD device(s) meets the requirements of:

.1 UL 1449 - as well as;

.2 CSA Approval;

.3 Ontario Electrical Safety Code;

.4 Provide the following supporting Product Data:

.1 For each type of SPD product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

.2 Provide verification the SPD is listed or recognized through Underwriters Laboratories to UL 1449.

.3 Operations and Maintenance Data: SPDs to be included in the operation and maintenance manuals.

.4 Warranties: SPD warranties to be included in the O&M manuals.

.3 Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and start-up of the product(s). Indicate maximum size of circuit breaker or fuse to be connected for each unit.

.4 List and detail all protection systems such as fuses, disconnecting means and protective features.

.5 Provide actual let through voltage test data in the form of oscillograph results for the IEEE C62.41 Category “C” & “B” impulse and ringwave tested in accordance with IEEE C62.45.

1.5 QUALITY ASSURANCE

.1 Quality Assurance Submittals: submit following in accordance with Section 01 05 03 - Quality Control.

.2 Certificates: submit production certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Submit three (3) copies of certified factory test results.

.4 Instructions: submit manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual in accordance with Section 01 78 00.

.2 3 copies maintenance data for complete assembly including components.

.3 Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

1.7 SYSTEM

.1 This section describes the electrical and mechanical requirements for a transient surge protection system.

.2 The specified system shall provide effective, surge energy (voltage and current) diversion and be suitable for application in ANSI/IEEE C62.41 Category “B” and “C” environments (as described by ANSI/IEEE C62.41.1).

.3 Surge Protective Devices (SPDs) shall be compatible with non-linear loads and consist of high performance metal-oxide varistors designed to provide impulse transient voltage surge suppression and ring wave surge noise filtering.

.4 SPDs shall be connected in parallel with the electrical distribution system unless otherwise noted or indicated.

.5 The operation of an SPD shall not be affected by or interact with any other filter or power factor correction or harmonic reduction equipment installed on the electrical distribution system.

.6 SPDs shall be mounted within the panelboards and distribution equipment and be manufactured by the same manufacturer of the equipment. The SPD unit shall be connected to the distribution equipment via a 30 amp 3 pole circuit breaker from within the distribution equipment in order that the SPD unit can be serviced. The SPD unit shall be of modular design.

1.8 DEFINITIONS

.1 $I_{(n)}$: Nominal discharge current rating.

.2 MCOV: Maximum continuous operating voltage.

.3 Protection Modes: The pair of electrical connections where the VPR applies.

.4 MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

.5 OCPD: Overcurrent protective device.

.6 SCCR: Short-circuit current rating.

.7 SPD: Surge protective device.

.8 VPR: Voltage protection rating.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 SPDs shall not generate any appreciable magnetic fields.

.2 SPDs shall be capable of use in computer rooms without danger to data storage systems or devices.

.3 SPD operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.

.4 SPDs shall not generate any audible noise during normal operation.

1.10 WARRANTY

.1 The manufacturer shall provide a full 10-year parts and labour warranty from date of substantial completion against failure when installed in compliance with manufacturer’s written instructions, ULC listing requirements, and any applicable national and local electrical codes. Manufacturer shall make available for consultation, (local, national) engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or the nearest dispatch centre shall be stated in the Project Bid Form.

.2 An SPD that shows evidence of failure or incorrect operation during

the warranty period shall be replaced free of charge. Since “Acts of Nature” or similar statements typically include the threat of lightning to which the SPD’s shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. That is, the warranty must specifically provide for unlimited free replacements in the event of failure caused by the effects of lightning and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

.3 The installation of SPDs in or on electrical distribution equipment shall in no way compromise or violate equipment listing, labelling, or warranty of the distribution equipment or its components.

1.11 MANUFACTURER

.1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

.2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Department Representative, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.12 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of manufacturer’s instructions shall be included with the equipment at time of shipment.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

.1 SPD with Accessories: Listed and labeled as defined in NFPA 70.12, by Underwriters Laboratories, and marked for intended location and application.

.2 Comply with Underwriters Laboratories UL 1449 – Surge.

.3 Comply with Underwriters Laboratories UL 1283 (Applies to all Type 2 SPDs).

.4 Designed in accordance with IEEE C62.41.1, C62.41.2 and C62.45.

.5 SPDs manufacturer shall be ISO-9001 1.2 certified.

.6 MCOV of the SPDs shall not be less than 115% for 480Y/277V and 125% for 240Y/120V nominal RMS system voltages.

.7 SPDs installed internal to the distribution equipment shall be of the same manufacturer as the equipment. The equipment shall be fully tested and certified to the following UL standards:

.1 UL 67 1.2 = Panelboards.

.8 Surge Current Rating: The surge current rating of the SPD shall be dependent of its Category/Location,

Category/Location	Application	Per Phase	Per Mode
C	Service Entrance	240 kA	120 kA
B	Distribution	160 kA	80 kA

.9 Protection modes: UL 1449 – 3rd Edition, **VPR** for Delta configured circuits shall not exceed the following:

Modes	240D	600D
L-G; N-G	1200 V	2500 V

.10 SCCR: As per the Ontario Electrical Safety Code the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.

.11 Nominal Discharge Current Rating: 20 kA $I_{(n)}$.

.1 Facilities that have a Lightning Protection System installed or scheduled to be installed shall be provided with a Surge Protective Device that carries a minimum Nominal Discharge Current Rating of 20kA.

2.2 PANELBOARD SUPPRESSORS

.1 SPDs: Shall comply with UL 1449 3rd Edition.

.1 Type 1 or Type 2 SPD.

.2 Type 2 SPDs shall also comply with UL 1283.

.2 Provide SPDs with the following:

.1 Indicator light(s) for power and protection status.

.2 Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.

.3 Audible Alarm with complete with a silencing switch.

.4 Form-C contacts - One normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building management system.

.5 Surge counter complete with a reset switch.

.3 Surge Current Rating: The surge current rating of the SPD shall be dependent of its Category/Location.

Category/Location	Application	Per Phase	Per Mode
B	Distribution	160 kA	80 kA
B	Branch	120 kA	60 kA

.4 Protection modes: UL 1449 – 3rd Edition, **VPR** for grounded WYE configured circuits shall not exceed the following:

Modes	208Y/120	600Y/347
L-N; L-G; N-G	800 V	1500 V
L-L	1200 V	2500 V

.5 Protection modes: UL 1449 –, **VPR** for Delta configured circuits shall not exceed the following:

Modes	240D	600D
L-G; N-G	1200 V	2500 V

.6 SCCR: As per the Canadian Electrical Code the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.

.7 Nominal Discharge Current Rating: Minimum of 10 kA $I_{(n)}$.

2.3 ENCLOSURES

.1 Enclosures shall meet or exceed the ratings for the environment to be installed as indicated on the drawings.

.2 Indoor Enclosures: NEMA 250, Type 3R.

.3 Outdoor Enclosures: NEMA 250, Type 3R, 4X.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Refer to the project power distribution diagrams for additional SPDs requirements to be met and or provided.

.2 Install SPD devices at the service entrance in accordance with the CSA C22.1 Canadian Electrical Code.

.3 All SPDs installed on the line side of the service entrance distribution equipment OCPD shall be Type 1 SPDs.

.4 All SPDs installed on the load side of the OCPD shall be Type 2 SPDs and be provided with an over current protective device.

.5 All SPDs must be rated for the distribution system short circuit level based upon the approved Short Circuit and System Coordination Studies.

.6 Follow manufacturer’s installation practice recommendations.

.7 Provide a minimum 30 Amp 3-pole circuit breaker as a dedicated disconnecting means for the SPD unit unless otherwise indicated.

.8 Install SPDs with properly rated conductors (minimum wire size shall be No.10 copper twisted AWG) between the suppressor and points of attachment as short and straight as possible; adjust circuit-breaker positions to achieve shortest and straightest leads lengths.

.9 Twist input conductors together to reduce the input inductance.

.10 Do not splice and extend SPD leads unless specifically permitted by manufacturer and written direction have been issued by the departmental reprehensive to this effect.

.11 Connect into building automation system for remote monitoring of the SPD device.

3.2 FIELD QUALITY CONTROL

.1 Perform the following tests and inspections in accordance with section 01 91 00.

.2 Compare equipment nameplate data for compliance with Drawings and Specifications.

.3 Inspect anchorage, alignment, grounding, and clearances.

.4 Verify that electrical wiring installation complies with manufacturer's written installation requirements.

.5 An SPD will be considered defective if it does not pass inspections.

.6 Prepare inspection reports.

3.3 START-UP SERVICE

.1 Complete start-up checks in accordance with the manufacturer's written instructions.

.2 Verify that SPDs within electrical Switchboards etc. have been energized as many vendors ship this equipment to the site in the off position.

.3 Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect all wires, including neutral of the SPD before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

.4 Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CAN/CSA-C22.2 No. 144-M91(R2015), Ground Fault Circuit Interrupters.
.2 CSA C22.2 No.144.1-16, Ground-Fault Circuit-Interrupters (Tri-National Standard With UL 943 and NMX-J-520-ANCE).

.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA PB 2.2-2014, Application Guide for Ground Fault Protection Devices for Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault equipment protection and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.1 Indicate on drawings.

.4 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for ground fault equipment protection for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect ground fault equipment protection from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Ground fault protective equipment: components of one manufacturer.

.2 Provide ground fault protection on 400A, 240V, 3-wire, 1-phase service: to NEMA PB 2.2 and CAN/CSA-C22.2 No. 144 and CSA C22.2 No.144.1.

.3 Ground fault unit to contain:
- .1 Ground sensing relay suitable for operation at 500mA factory set. 240V.
- .2 Ammeter with scale 0 to 1.0 A to indicate ground current value.
- .3 Three position sensitivity control switch to select value of leakage current at which relay will operate.
- .4 Indicating lamp illuminated when no ground fault exists, extinguished on ground fault or test.
- .5 Switch:
  - .1 SPDT contacts for alarm.
  - .2 Mechanical target indication.
  - .3 Manual reset.
- .6 Reset button for contacts and target.
- .7 Suitable for panel mounting.

.4 Neutral:
- .1 Use an artificial neutral and grounding resistor.
- .2 Use neutral ground resistor unit.

.5 System to operate instantaneously at ground current setting.

2.2 FABRICATION

.1 Install following components in equipment specified in other Sections and as indicated.
- .1 Zero sequence transformer.
- .2 Ground fault relay.
- .3 Ground resistor unit.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault equipment installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed

from Departmental Representative.

3.2 INSTALLATION

.1 Do not ground neutral on load side of sensor.

.2 Install phase conductors including neutral through zero sequence transformer.

.3 Install ground fault protection system.

.4 Make connections as indicated and in accordance with manufacturer's written recommendations.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 and co-ordinate with Section 01 45 00 if required.

.2 Arrange for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.

.3 Demonstrate simulated ground fault tests.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.144.1-16, Ground Fault Circuit Interrupters.

1.2 ACTION AND INFORMATIONAL

.1 Submit in accordance with Section 01 33 00.

1.3 SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.4 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect ground fault circuit interrupters.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CSA C22.2 No.144.1.

.2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

.1 Single or Two pole ground fault circuit interrupter for 15 or 20A, 120V, single-phase circuit c/w test and reset facilities.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 and co-ordinate with Section 01 45 00 if required.

.2 Arrange for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.

.3 Demonstrate simulated ground fault tests.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Non-fusible, disconnect switch in CSA Enclosure 1R, size as indicated.

.2 Provision for padlocking in off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Indicate name of load controlled on Size 4 nameplate.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.14-18, Industrial Control Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for contactors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for contactors for incorporation into manual.

.3 Include operating information required for start-up, synchronizing and shut-down of generating units.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect contactors from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.4 Mount in NEMA Enclosure 1R unless otherwise indicated.

.5 Include following options in cover:
.1 Red and Green indicating lamp.
.2 Stop-Start pushbutton.
.3 Hand-Off-Auto selector switch.
.4 On-Off selector switch.

.6 Control transformer: in accordance with control devices, factory wired and installed in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00.

.2 Size 4 nameplate indicating name of load controlled.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install contactors and connect power wires and auxiliary control devices.

.2 Identify contactors with nameplates or labels indicating panel and circuit number.

.3 Test contactors in accordance with Section 26 05 00.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by contactor installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.14-18, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA ICS 1-2000(R2015), Industrial Control and Systems: General Requirements.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for control devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Include schematic, wiring, interconnection diagrams.

1.3 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 00.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for control devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect control devices from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.

.2 Convertible contact type: contacts field convertible from NO to NC, electrically held permanent magnet type with sliding barrier to permit access to contacts only.

.3 Sealed contact type: with poles and front mounted contact block to provide poles. Coil rating: 120V, 20VA.

.4 Universal pole type: convertible from NO to NC by changing wiring connections.

.5 Fixed contact plug-in type:

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open, convertible to normally-closed in field.

2.3 OILTIGHT LIMIT SWITCHES

.1 Snap action type: lever stick actuator, CSA type 1 open type enclosure. Contact rating NEMA ICS 120V, 20A AC.

.2 Surface mounted.

.3 Socket bases and DIN mounting rails for plug-in type relays.

2.4 CONTROL AND RELAY PANELS

.1 CSA Type 1 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.5 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 240 V, 60 Hz ac.

.3 Secondary: 120 V, AC.

.4 Rating: 50VA.

.5 Secondary fuse: 3A.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for control devices installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices and interconnect.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 International Electrotechnical Commission (IEC)
.1 IEC 60947-4-1:2018/ISH1:2020, Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Provide shop drawings: in accordance with Section 01 33 00.
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Provide shop drawings for each type of starter to indicate:
.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout and components.
.4 Enclosure types.
.5 Wiring diagram.
.6 Interconnection diagrams.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 Submit operation and maintenance data for each type and style of motorstarter for incorporation into maintenance manual.

.3 Extra Materials:
.1 Provide listed spare parts for each different size and type of starter.
.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformers.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates paddling and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Starters: to IEC 60947-4-1 with AC4 utilization category.

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
.1 Contactor solenoid operated, rapid action type.
.2 Motor overload protective device in each phase, manually reset from outside enclosure.
.3 Wiring and schematic diagram inside starter enclosure in visible location.
.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fused disconnect switch motor circuit interrupter with operating lever on outside of enclosure to control disconnect motor circuit and provision for:
.1 Locking in "OFF" position with up to 3 padlocks.
.2 Independent locking of enclosure door.
.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:
.1 Pushbuttons Selector switches labelled as indicated.
.2 Indicating lights: standard type and color as indicated.
.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.3 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.4 ACCESSORIES

.1 Pushbutton: heavy duty, oil tight as required.

.2 Selector switches: heavy duty, oil tight as required.

.3 Indicating lights: heavy duty, oil tight, type and colour as indicated.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 01.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Magnetic starter designation label, white plate, black letters, size as required engraved as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 00.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Outdoor 38 kW 1-phase, 120/240V packaged backup power gaseous propane engine driven generator set complete with sound attenuated weatherproof enclosure and conduit stub-up cover.

1.2 REFERENCES

.1 Section 26 32 13.03 INSTALLATION OF GAS POWER GENERATING EQUIPMENT.

.2 National Electrical Manufacturers' Association (NEMA)
.1 NEMA MG1-2016, Motors and Generators.

.3 International Organization for Standardization (ISO)
.1 ISO 3046-1:2002, Reciprocating internal combustion engines - Performance - Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use.

.4 Canadian Standards Association (CSA)
.1 CSA B51:19, Boiler, Pressure Vessel, and Pressure Piping Code
.2 CSA B149.1-20, Natural Gas and Propane Installation Code
.3 CSA B149.2-15, Propane Storage and Handling Code
.4 CSA C282-19, Emergency Electrical Power Supply for Buildings.

.5 Canadian General Standard Board (CGSB)
.1 CAN/CGSB-3.14-2018, Propane for Fuel Purposes

1.3 SYSTEM DESCRIPTION

.1 Generating system consists of:
.1 Gas engine.
.2 Alternator.
.3 Alternator control panel.
.4 Automatic transfer equipment.
.5 Battery charger and battery.
.6 Fuel storage and supply system.
.7 Exhaust system.
.8 Steel mounting base.
.9 Exterior enclosure with sound attenuation.

.2 System designed to operate as backup power source unattended in remote location.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Include:
.1 Engine: make and model, with performance curves.
.2 Alternator: make and model.
.3 Voltage regulator: make, model and type.
.4 Automatic transfer switch: make, model and type.

.5 Battery: make, type and capacity.
.6 Battery charger: make, type and model.
.7 Alternator control panel: make and type of meters and controls.
.8 Governor type and model.
.9 British standard or DIN rating of engine.
.10 Dimensioned drawing showing complete generating set mounted on base, including vibration isolators and total weight.
.11 Continuous full load output of set at 0.8PF lagging.
.12 Description of set operation including:
.1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.
.2 Manual starting.
.3 Automatic shut down and alarm on:
.1 Overcranking.
.2 Overspeed.
.3 High engine temp.
.4 Low lube oil pressure.
.5 Short circuit.
.6 Alternator overvoltage.
.7 Lube oil high temperature.
.8 Over temperature on alternator.
.4 Manual remote emergency stop.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Gas generator for incorporation into manual specified in Section 01 78 00.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:
.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, battery charger, battery, fuel system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:
.1 Illustrated parts lists with parts catalogue numbers.
.2 Schematic diagram of electrical controls.
.3 Flow diagrams for:
.1 Fuel system.
.2 Lubricating oil.
.3 Cooling system.
.4 Certified copy of factory test results.
.5 Maintenance and overhaul instructions and schedules.
.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of all packaging materials at appropriate

recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

.6 Divert unused batteries from landfill to battery recycling facility approved by Departmental Representative.

.7 Divert unused lubricating oil materials from landfill to oil recycling facility approved by Departmental Representative.

.8 Divert unused antifreeze from landfill to antifreeze recycling facility approved by Departmental Representative.

.9 Fold up metal banding, flatten and place in designated area for recycling.

1.7 WARRANTY

.1 For Work of this Section the 12 month warranty period is extended to 60 months or 2000 operating hours, whichever occurs first.

1.8 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 Include:
.1 2 lube oil filter replacement elements.
.2 2 air cleaner filter elements.
.3 2 sets of fuses for control panel.
.4 Special tools for unit servicing.

PART 2 - PRODUCTS

2.1 GAS ENGINE

.1 Gas engine: to ISO 3046-1.
.1 Engine: standard product of current manufacture, from company regularly engaged in production of such equipment.

.2 Synchronous speed 1800 r/min.

.3 Capacity:
.1 Rated continuous power 38 kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows: Rated continuous output = Generator kW divided by Generator efficiency at full load.
.1 Under following site conditions:
.1 Ambient temperature.

.4 Cooling System:
.1 Liquid cooled: heavy duty industrial radiator mounted with ethylene glycol anti-freeze non-sludging above minus 46 degrees C.
.2 To maintain manufacturer's recommended engine temperature range in ambient temperature of 40 degrees C.
.3 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start at ambient temperatures below 0 degrees C.
.1 Switch and fuse in heater circuit and fed from line side of automatic transfer switch.

.5 Fuel:
.1 Propane gas fuel: to CAN/CGSB-3.14.
.2 LP fuel level monitor: provide constant monitoring of LP fuel tank’s fuel level. Wi-Fi monitoring capability, with status and alerts via no-cost electronic device application.

.6 Fuel system: gaseous propane, 2.74-3.48 kPa (11-14” WC)operating fuel pressure, fuel solenoid energized when engine running.

.7 Governor:
.1 Electronic with:
.1 Isochronous frequency regulation.
.2 Steady state regulation of plus or minus 0.25%.

.8 Lubrication system:
.1 Pressure lubricated by engine driven pump.
.2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.
.3 Lube oil cooler.
.5 Oil level dip-stick.

.9 Starting system:
.1 Positive shift, gear engaging starter 12 or 24V dc.
.2 Cranking limiter to provide 3 cranking periods of 16 s duration, each separated by 7 s rest.
.3 Lead acid, 12 or 24V storage battery not less than 525 CCA, with sufficient capacity to crank engine for 1 min at 0 degrees C without using more than 25% of ampere hour capacity.
.4 Battery charger : constant voltage, solid state. Regulation: plus or minus 1% output for plus or minus 10% input variation. Minimum charger capacity: 2.5 A.
.4 Battery Warmer: thermostatically controlled heater connected to line side of automatic transfer switch to allow engine to start at ambient temperatures below 0 degrees C.

.10 Vibration isolated engine instrument panel with:
.1 Lube oil pressure gauge.
.2 Lube oil temperature gauge.
.3 Lube oil level gauge.
.4 Coolant temperature gauge.
.5 Coolant level gauge.
.6 Running time meter: non-tamper type.

.11 Guards to protect personnel from hot and moving parts. Locate guards

so that normal daily maintenance inspections can be undertaken without their removal.

2.2 ALTERNATOR

.1 Alternator: to ANSI/NEMA MG1.

.2 Rating: 1 phase, 240V, 3-wire, 38 kW, 60Hz, at 0.8PF.

.3 Output at 25 degrees C ambient:
.1 100% full load continuously.

.4 Revolving field, brushless, sealed ball bearing.

.5 Amortisseur windings.

.6 Synchronous type.

.7 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.

.8 Exciter: direct or rotating brushless.

.9 EEMAC NEMAclass F H insulation on windings.

.10 Embedded in stator winding and connected to alternator control circuitry.

.11 Voltage regulator: thyristor controlled rectifiers with phase controlled sensing circuit:
.1 Stability: maximum voltage variation at any constant load from no load to full load.
.2 Regulation: maximum voltage deviation between no-load steady state and full-load steady state.
.3 Transient: maximum voltage dip on one-step application of 0.8PF full load.
.4 Transient: maximum voltage rise on one-step removal of 0.8PF full load.
.5 Transient: maximum voltage recovery time with application or removal of 0.8PF full load.

2.3 CONTROL PANEL

.1 Totally enclosed, mounting base isolated from gas generator.

.2 Controls:
.1 Engine start button.
.2 Selector switch: Off-Auto-Manual. Auto mode to include automatic generator exerciser at intervals not exceeding 30 days.
.3 Engine emergency stop button and provision for remote emergency stop button.
.1 Alternator output breaker:
.1 Circuit breaker: moulded case, temperature compensated for 40 degrees C ambient, dual thermal-magnetic trip.
.2 Operating lights or display:

.1 "Normal power" pilot light.
.2 "Standby power" pilot light.
.3 Remote monitoring of generator status from location designated on drawings.

2.4 STEEL MOUNTING BASE

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators and control console resiliently mounted.
.1 Spring type isolators with adjustable side snubbers and adjustable for levelling.

.3 Sound insulation pads for installation between isolators and concrete base.

2.5 EXHAUST SYSTEM

.1 Generator unit enclosure is complete with an integrated exhaust system.

2.6 FUEL SYSTEM

.1 Fuel storage tanks: to CSA B149.2 and CSA B51

.2 Fuel supply system: to CSA B149.1

2.7 COOLING AIR SYSTEM

.1 Engine ventilating system:
.1 Integral within the outdoor unit.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Control panel:
.1 Size 2 3 nameplates for meters, alarms, indicating lights and minor controls.

2.9 FABRICATION

.1 Shop assemble generating unit including:
.1 Base.
.2 Engine and radiator.
.3 Alternator.
.4 Control panel.
.5 Battery and charger.

2.10 SOURCE QUALITY CONTROL

.1 Test generator set including engine, alternator, control panels, transfer switch and accessories in presence of Departmental Representative.

.2 Test procedure:

.1 Prepare blank forms and check sheet with spaces to record data. At top of first sheet record:

.1 Date.
.2 Generator set serial no.
.3 Engine, make, model, serial no.
.4 Alternator, make, model, serial no.
.5 Voltage regulator, make and model.
.6 Rating of generator set, KW kV.A, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

.3 Departmental Representative's signature on completed forms to indicate concurrence in results of test.

.3 Tests:

.1 With 100% rated load, operate set for 4 h, taking readings at 30 min intervals, and record following:

.1 Time of reading.
.2 Running time.
.3 Ambient temp in degrees C.
.4 Lube oil pressure in kPa.
.5 Lube oil temp in degrees C.
.6 Engine coolant temp in degrees C.
.7 Exhaust stack temp in degrees C.
.8 Alternator voltage
.9 Alternator current
.10 Power in kW.
.11 Frequency in Hz.
.12 Power Factor.
.13 Battery charger current in A.
.14 Battery voltage.
.15 Alternator cooling air outlet temp.

.2 After completion of 8 hours run, demonstrate following shut down devices and alarms:

.1 Overcranking.
.2 Overspeed.
.3 High engine temp.
.4 Low lube oil pressure.
.5 Short circuit.
.6 Alternator overvoltage.
.7 Low battery voltage, or no battery charge.
.8 Manual remote emergency stop.
.9 High alternator temperature.

.4 Demonstrate:

.1 Automatic starting of set and automatic transfer of load on failure of normal power.
.2 Operation of manual bypass switch.
.3 Automatic shut-down of engine on resumption of normal power.

.5 Demonstrate low oil pressure and high engine temperature shutdown

devices operation without subjecting engine to these excesses.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate generating unit and install as indicated on concrete housekeeping pad.

.2 Install propane fuel storage tank on concrete housekeeping pad as indicated.
Propane tank shall:
.1 Have a Maximum Allowable Working Pressure (MAWP) of not less than 1750 kPa, and
.2 Be in accordance with CSA B51.

.3 Generator and propane tank housekeeping pads shall:
.1 Be of sufficient thickness and strength to support equipment and any operational (torquing) loads, and with the following minimum properties: 20.7 MPa concrete, 140 mm thick reinforced with 152x152 MW13.3/13.3 welded wire mesh, on a 100 mm compacted 19mm clear granular base,
.2 Be flat and level to within 13 mm,
.3 Be 300 mm wider and 300 mm longer than generator base,
.4 Extend 100 mm above finished grade,
.5 Have broom finished top surface, and
.6 Have vertical and top horizontal corners finished with a 12-19 mm radius edger.

.4 Install propane fuel supply system as indicated. Propane regulator and fuel pipe diameter shall be sized to operate generator at 110% full rated load. Fuel supply piping shall be sized on maximum 0.125 kPa pressure drop.
Secondary regulator shall:
.1 Be marked “direct acting”,
.2 Have a maximum droop of 0.25-0.5 kPa at all generator operating conditions, and
.3 Have an accuracy rating of 1% or less.

.5 Complete wiring and interconnections as indicated.

.6 Start generating set and test to ensure correct performance of components.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Notify Departmental Representative 10 working days in advance of test date.

.3 Provide fuel for testing and leave full tanks on acceptance.

.4 Demonstrate:
.1 Unit start, transfer to load, retransfer to normal power, unit

shut down, on "Automatic" control.
.2 Unit start and shut down on "Manual" control
.3 Unit start and transfer on "Test" control.
.4 Unit start on "Engine start" control.
.5 Operation of automatic alarms and shut down devices.

.5 Run unit on load for minimum period of 4 hours to show load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling.

.6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.

END OF SECTION

PART 1 - GENERAL

1.1 PAYMENT

.1 Submit payment for services of qualified gas electric technician.

1.2 REFERENCES

.1 CSA International

.1 CSA B149.1-20, Natural Gas and Propane Installation Code

.2 CSA B149.2-15, Propane Storage and Handling Code

.3 CSA C282-19, Emergency Electrical Power Supply for Buildings.

.2 U.S. Coast Guard Equipment List (USCG)

.1 164.009-11, Non-Combustible Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for generating equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit verification of gas electric technician qualification.

.4 Submit commissioning report.

1.4 QUALIFICATIONS

.1 Use qualified gas electric technician.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Include materials as follows:

.1 Conduits and boxes as required.

.2 Fuel lines, shutoffs, and fittings as required.

.3 ULC automatic fire shut-off valve.

.4 Electrical components as indicated.

.5 Antifreeze, ethylene glycol.

.6 LP Gas fuel; LP storage tank initial fill, plus top-up after testing.

.7 Wiring and materials, including necessary rigid conduits and fittings for making connections.

.8 The power circuit cables will be No.4/0, RW90 (-40 degrees C) cross link polyethylene.

.9 The control circuit cables will not be less than No. 18 LVT cable.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for generating equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 LOCATING AND MOUNTING

.1 Locate unit as indicated.

.2 Fit and adjust isolators in accordance with manufacturer's installation and adjustment instruction bulletin contained in unit manual.

.3 Do not bolt housings to foundation if isolator housing feet are equipped with 6 mm rubber sound pads.

3.3 ALIGNMENT CHECK

.1 Since Engine-generator shaft alignment is adjusted at factory, check to ensure that no change has occurred due to shipment and handling.

.2 Where engine and generator housings are close coupled and instruments at hand are not suitable for measuring alignment within confines of housings, loosen engine and generator hold down bolts and ensure that each foot is carrying proportionate amount of weight and feet are level on base plate.

3.4 FUEL SUPPLY SYSTEM

.1 Install fuel tanks to CSA B149.2.

.2 Install fuel lines to CSA B149.1.

.3 Inspect thoroughly fuel tank and lines to confirm they are clean and free of foreign material before connecting fuel system.

.4 Install primary regulator, secondary regulator and servicing shut-off valve downstream of secondary regulator at propane housekeeping pad

with rigid Schedule 40 pipe. Mechanically support pipe at housekeeping pad.

.5 Install underground fuel supply between engine and secondary regulator at propane tank. Underground fuel line shall consist of a single piece of pipe. Intermediate underground pipe joints are unacceptable. Mechanically protect underground pipe and use tracer wire where required. Entirely replace leaking fuel lines.

.6 Neatly install fuel lines parallel or perpendicular to building lines with no kinks or dents.

.7 Install certified transition risers at each end of underground PE pipe.

.8 Install soft drawn copper fuel lines using brass 45 degrees flare and pipe fittings as required and bend with correct size lever type bending tool.

.9 Install external manual fuel shutoff valve, sediment trap, and union at generator stub up. Shut off valve shall include manometer port. Static and dynamic (generator running at full load) fuel pressure shall be measured and recorded. Fuel pressure shall not drop below 2.74 kPa (11" WC).

.10 Install flexible section between the engine and fuel supply riser shutoff valve, using materials supplied with unit.

3.5 FUEL SUPPLY TESTING

.1 Installed fuel supply piping shall be purged and leak tested.

.2 At startup, measure fuel supply pressure at each of the following conditions at the generator fuel shutoff valve test port or at the generator's test port if equipped:

.1 Static Pressure: Fuel supply pressure when unit is not running. Shall be between minimum and maximum pressures for propane in the generator unit specification sheet.

.2 Cranking Pressure: Fuel supply pressure when the unit is cranking. Must not drop more than 0.25 kPa (1" WC) below static pressure or below minimum pressure listed in the generator unit's specification sheet.

.3 Running – No Load Pressure: Fuel supply pressure when the unit is running at rated frequency and voltage with no load. Shall be at or slightly below maximum pressure listed in generator unit specification sheet.

.4 Running – Full Load Pressure: Fuel supply pressure when the unit is running at full rated load. Fuel supply pressure shall not drop more than 0.5 kPa (2" WC) from the Running – No Load Pressure and shall not drop below minimum pressure listed in generator unit specification sheet.

3.5 BATTERIES AND CHARGER

.1 For dry charged batteries, activate in accordance with manufacturer's instructions manual prior to installation.

.2 For wet batteries, inspect individually each battery cell and check electrolyte level.

.1 Check charge condition by measuring temperature and specific gravity of electrolyte.

.2 Consult manufacturer's instructions for recommended readings.

.3 If readings are lower, give batteries freshening charge until readings are reached.

.3 Locate batteries as indicated and ensure batteries are accessible for service.

.1 Run and protect cables to starting motor using cables supplied with unit.

.4 Clean connections and tighten securely.

3.8 CONTROL AND TRANSFER PANEL

.1 Locate panels as indicated.

.2 Make control and power circuit connections as indicated.

.3 Identify cables at both ends.

.4 Tag with slip-on wire maker, each wire end with number corresponding to number in panel.

.5 Make terminations with self-insulated terminals of flanged fork or ring type.

3.9 ADDITIONAL WORKS

.1 Complete any additional work as instructed by Departmental Representative to:

.1 Ensure equipment is safe to operate.

.2 Provide complete and operating system.

3.10 FIELD QUALITY CONTROL

.1 Qualified gas electric technician to: inspect and verify that installation of interruptible power unit is acceptable and complete. Provide inspection report to the Departmental Representative.

3.11 SYSTEM STARTUP

.1 Preparation: before starting unit, carry out thorough mechanical and electrical inspection of equipment, perform checks and adjustments identified in generator installation manual, and the following:

.1 Disconnect battery cables from batteries to prevent accidental starting.

.2 Turn engine several revolutions by means of hand-barring devices to ensure parts are free and there are no obstructions to its running.

.3 Check fluid levels and top up as necessary. Pre-lubricate engine and turbochargers as recommended by engine manufacturer. Install drip pan beneath engine.

.4 Confirm cooling system antifreeze is effective to at least minus 40 degrees C.

.5 Check belts for correct tension and adjust as necessary.

.6 Check and grease points.

.7 Check and tighten properly nuts, bolts.

.8 Confirm safety guards are in place and properly secured.

.9 Check linkages for damage and freedom of movement.

.10 Check fuel supply system for leakage.

.11 Ensure fuel supply systems are properly purge and primed.

.12 Check and tighten properly electrical connections.

.13 Check starting battery electrolyte level specific gravity and for proper installation.

.14 Check battery charger for proper operation and adjust as necessary.

.15 Check jacket coolant heater for proper operation.

.16 Complete additional preparations deemed necessary.

.2 Performance verification: on completion of start-up preparations, take following action:

.1 Reconnect starting battery cables to starting battery.

.2 Start unit only in presence of Departmental Representative and allow to warm up. Stop unit if abnormal conditions are encountered.

.3 Check for and correct leakage from exhaust system, fuel system, cooling system, and lubricating oil system.

.4 Adjust vibration isolators.

.5 Observe and confirm lubricating oil pressure and coolant temperature are within limits and no harmful vibration or sounds are evident.

.6 Ensure voltage is within operating parameters and automatic voltage regulator is operating correctly.

.7 Ensure manual voltage control is operating correctly.

.8 Ensure frequency is within operating parameters and electronic governor is operating correctly.

.9 Check engine air ventilation system for proper operation.

.10 Check operation of engine-mounted protective sensing devices and adjust as necessary.

.11 Check operation of electronic controller protection, transfer,

timing, metering, and annunciator functions and adjust as necessary.

.12 Check operation and calibration of analog metering and adjust as necessary.

.13 Apply electrical load, read the metres, and correlate these readings.

.14 Demonstrate:

.1 Unit start, transfer to load, retransfer to normal power, unit shutdown, on "automatic" control.

.2 Unit start, transfer to load, retransfer to normal power, unit shutdown, on "test control". Unit start and shutdown, on "engine start" control.

.3 Unit cranking, start, and shut-down by means of engine-mounted switch.

.4 Run unit on full nameplate load for minimum period of 4 hours to show load-carrying capability, stability of voltage and frequency, and satisfactory performance of engine ventilating system to provide adequate cooling, exhaust system.

.5 Every 1/2 hour carry out and record readings on Test Chart.

.15 Perform additional tests as required by Departmental Representative to confirm unit is operating satisfactorily.

3.12 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.13 DEMONSTRATION AND TRAINING

.1 As directed by Departmental Representative and in accordance with Section 01 79 00 carry out demonstrations of complete interruptible power unit for Project Acceptance.

.2 Deliver familiarization training to operating and maintenance staff.

.1 Include instruction to site operation and maintenance staff for proper care, operation, and maintenance of equipment.

.2 Maintain services for such period, and for as many visits as necessary to put equipment in operation, and confirm that operating personnel are conversant with aspects of its care and operation.

.3 Include fuel required for performing gas-generator site test and top-up

after acceptance test completion.

3.14 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect fuel lines from mechanical damage.

.3 Repair damage to adjacent materials caused by electric power generating equipment installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA-C813.1-14(R2019) Performance Test Method for Uninterruptible Power Supplies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data: include information as follows:

.1 Catalogue information.
.2 Description of system operation.
.3 Full load 2kVA output at 0.9 % lagging power factor.
.4 Efficiency of system at 25%, 50%, 75% and 100% rated load.
.5 Type of ventilation.
.6 Battery:
.1 Number of batteries.
.2 Maximum and minimum voltages.
.3 Type of battery.
.4 Maximum short circuit current.
.5 Maximum charging current expected for fully discharged condition.
.6 Recommended low voltage limit for fully discharged condition.
.7 Inverter:
.1 Type.
.2 DC current at minimum battery voltage to produce full load AC output.
.8 Rectifier:
.1 Type and capacity.
.2 Battery charging sequence.
.3 Current-time data for Silicon Controlled Rectifier (SCR) protective devices.
.9 Evaluation of Canadian content.
.10 Heat losses at no load, 25%, 50%, 75% and 100% of rated output, in kW.
.11 Typical operation and maintenance manual.
.12 Description of factory test facilities.
.13 Manufacturer's maintenance capabilities including:
.1 Willingness to undertake maintenance contract.
.2 Number of trained personnel available.
.3 Location of trained personnel and repair facilities.
.14 Manufacturer's written installation recommendations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for uninterruptible power systems static (UPS) for incorporation into manual.

.3 Operation and Maintenance Manual to include:

.1 Operation and maintenance instructions concerning design elements, construction features, component functions and maintenance requirements to permit effective operations maintenance and repair.

.2 Technical data:

.1 Approved shop drawings.

.2 Technical description of components.

.3 Parts lists with names and addresses of suppliers.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging.

.2 Storage and Handling Requirements:

.1 Adequately enclosed and protected from weather and shipping damage.

.2 Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1.5 WARRANTY

.1 For the Work of this Section 26 33 53 - Uninterruptible Power Systems Static, 12 months warranty period is extended to 24 months.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 System to consist of 482.60 mm rackmount enclosure housing complete UPS system:

.1 120 Volt input, 2 kVA, 1800 Watt output capacity online double-conversion UPS.

.2 Rectifier/Inverter.

.3 Battery.

.4 Frequency regulation

.5 Voltage Regulation.

.6 Surge suppression.

.7 Bypass/Isolate Switch.

.8 Controls and meters.

.9 NEMA 5-15/20R outlet strip.

.2 Ensure system uses normal power supply mains and battery to provide continuous, regulated AC power to isolated load.

.3 Equipment: capable of operating continuously and unattended.

.4 Ensure that Uninterruptible Power Systems (UPS) is compatible with equipment that it feeds and with source from which it is fed.

2.2 PERFORMANCE

.1 Normal/Online (double conversion) operation:

.1 System converts mains AC input to DC power, then converts DC power to fully regulated pure sine wave AC output power.

.2 System performance and reliability:

.1 Consider any deviation from the required output power waveform as failure in UPS.

.2 Battery operation:

.1 System transfers automatically to battery operation with zero transfer time.

.1 When manually selected at control panel.

.2 When mains power fails.

.3 When mains power exhibits voltage or frequency instability.

.3 Internal Static Bypass operation:

.1 Ensure system can be bypassed for maintenance purposes, automatically by manual selection at control panel to connect load directly to AC mains. Transfer without load interruption and leaving inverter energized.

.2 Load transfer from mains back to system automatically by manual selection at control panel when maintenance completed.

2.3 UNINTERRUPTIBLE POWER SYSTEM

.1 Input power:

.1 Single phase, 120 V, 3 wire, grounded neutral, 60 Hz.

.2 Normal supply from AC mains or solar array inverter.

.3 Emergency supply from standby automatic gas engine unit.

.2 Output power:

.1 Single phase, 120 V, 3 wire, grounded neutral, 60 Hz.

.2 Full load output at 0.9 power factor lagging 2 kVA.

.3 Overload capability: 125% of rated full load current at 0.9 power factor and rated voltage for 1 minute.

.4 Frequency - nominal 60 Hz:

.1 Maximum variation from set value under load changes, including transients, 0.3 Hz maximum.

.5 Duration of full load output after mains failure not less than 4 minutes

.6 Output voltage control:

.1 Voltage regulation: voltage not to change by more than 3% as load increases gradually from zero to 100%, or for specified duration of full load after mains failure.

.2 Overvoltage correction: correct overvoltage to 150 V (0-100% load)

.3 Undervoltage correction: Correct undervoltage to 100 V at full load

.4 Severe undervoltage correction: Correct brownouts to 70 V (70% load) and 55 V (33% load)

.5 Harmonics over entire load range:

.1 Total RMS value not to exceed 5% RMS value of total output voltage.

.7 Efficiency: Overall system efficiency at rated load with battery fully charged not less than 80%.

.8 Interference suppression:

.1 If UPS equipment generates electromagnetic rf interference at levels which adversely affects other equipment in vicinity, UPS shall include suppression circuits or shielding as required to eliminate such interference.

2.4 ENCLOSURE

.1 All in one rackmount steel enclosure.

.2 Access from front or from rear.

.3 Ambient temperature range during operation 0 degrees C to +40 degrees C. Natural or forced ventilation as required.

.1 The enclosure shall have fans, with fan failures alarmed. Air inlet and outlet openings protected with screens and metal guards.

.4 Enclosure frames interconnected by ground with ground lug for connection to ground.

.5 Meters and controls: grouped on front panel.

.6 NEMA 5-15/20R outlet strip (minimum 6 outlets) at rear panel.

2.5 RECTIFIER

.1 Input power supply from:

.1 AC mains.

.2 Solar array inverter.

.3 Automatic gas engine driven generating unit.

.2 Surge suppressor: to protect equipment from supply voltage switching transients.

.3 Rectifier:

.1 Silicon controlled rectifier assembly or sealed silicon diodes.

.4 Filter: for rectifier DC output.

2.6 INVERTER

.1 Input power supply from:

.1 Rectifier DC output.

.2 Battery DC output.

.2 Output: pure sine wave

.3 Meters and controls: grouped on front panel.

2.7 BATTERY

.1 Battery to be hot swappable.

.2 Discharge current to supply inverter at full load output, for 4 minutes.

.3 Extended runtime to be supported via optional external battery packs.

2.8 SOURCE QUALITY CONTROL

.1 Complete system including rectifier, inverter, bypass switch, controls and battery factory tested in presence of Departmental Representative.

.2 Test procedures:

.1 Test the UPS unit in accordance with the manufacturer’s recommendations.

.2 Include information from original test as part of Operations and Maintenance Manual.

.3 Test equipment:

.1 Dummy load for testing, adjustable to 150 % of system rated output at 0.8 power factor lagging.

.4 Tests:

.1 Visual inspection to determine:

.1 Materials, workmanship, and assembly conform with design requirements.

.2 Battery and components are not damaged.

.3 Each battery cell polarity and polarity of connections to inverter are correct.

.4 Proper size fuses are installed.

.5 Meters have suitable range.

.6 Accessories are present.

.7 Portable meters for acceptance tests are suitable and instrument transformers connected correctly.

.2 Battery:

.1 Charge battery by connecting unit to AC mains power until cells are fully charged prior to powering connected loads.

.3 Demonstrate:

.1 System start-up and shut down.

.2 Operation from AC mains, solar array power, generator power.

.3 Operation during mains power failure, loss of solar array power, loss of generator power.

.4 Manual bypass.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for uninterruptible power systems static (UPS) installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

3.2 INSTALLATION

.1 Locate UPS cabinet, battery rack and battery in server rack as indicated.

.2 Assemble and interconnect components to provide complete UPS as specified.

.3 Connect AC mains to main input terminal.

.4 Connect UPS output to load.

.5 Start-up UPS and make preliminary tests to ensure satisfactory performance.

3.3 TESTING

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/CSA-C813.1.

.2 Tests:

.1 Inspection of electrical connections.

.2 Demonstration of system start-up and shut-down.

.3 Run UPS at full rated load to demonstrate proper operation with AC mains input, solar array inverter input, emergency generator input, no AC input.

.4 Discharge battery by operating UPS with AC mains open for specified duration of full load.

3.4 START-UP

.1 Arrange with Departmental Representative.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by UPS installation.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Service entrance rated integrated service disconnect, automatic transfer switch, and load management device.
.2 Discrete standby generator load management modules.
.3 Automatic transfer switch for solar package.

1.2 REFERENCES

.1 Gas Power Generation Section 26 32 13.01.

.2 Installation of Gas Power Generating Equipment Section 26 32 13.03.

.3 Solar Energy Electrical Power Generation Equipment – Dual-Axis Tracking Section 48 14 00.

.4 CSA International
.1 CSA C22.2 No.5-16, Moulded-Case Circuit Breakers, Molded-Case Tri-national standard with UL 489, NMX-J-266-ANCE-2013).
.2 CSA C22.2 No.178.1-14, Automatic Transfer Switches.
.3 CSA C282-19, Emergency Electrical Power Supply for Buildings.

.5 National Electrical Manufacturers Association (NEMA)
.1 NEMA ICS 2-2000(R2008), Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC, Part 8: Disconnect Devices for Use in Industrial Control Equipment.

1.3 SYSTEM DESCRIPTION

.1 ATS-1: Service entrance rated 400A 1-phase, 120/240V integrated service disconnect, automatic transfer switch, and load management device to transfer all electrical loads (except solar-powered loads) to backup generator in the event of interruption of normal power, and manage loads to prevent generator overload.
.1 Service entrance breaker/disconnect
.2 Transfer load from normal supply to standby unit when standby unit controller provides low-voltage signal.
.3 Transfer load from standby unit to normal power supply when normal power restored, confirmed by standby unit controller provides low-voltage signal
.4 Manage load shedding of minimum four 24 VAC HVAC controllers.

.2 LMM: Discrete line voltage load management modules in addition to the 24 VAC modules integrated into ATS-1, providing load shedding capability on identified loads to prevent generator overload, with prioritized recovery sequence.

.3 ATS-2: Automatic transfer switch to transfer solar package loads to normal/generator power in the event of insufficient solar and battery power to power downstream loads. Permits solar package to recharge its batteries once sufficient solar power is available, before transferring loads back to solar package. Controlled by normally open

relay in solar inverter. Refer to Section 48 14 00.
.1 Transfer solar package loads to normal grid power (or generator power if normal power has failed) upon closure of solar package inverter's "generator start" relay.
.2 Transfer load from normal supply to solar package supply when solar package inverter opens its "generator start" relay.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for transfer switches and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.1 Indicate on drawings:
.1 Make, model and type.
.2 Load classification:
.1 Restricted use: resistance and general loads, 0.8 pf or higher 50 kW.
.3 Single line diagram showing controls and relays.

.4 Description of equipment operation including:
.1 Automatic starting and transfer to standby unit and back to normal power.
.2 Test control.
.3 Manual control.
.4 Automatic shutdown.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for transfer switches for incorporation into manual.

.3 Detailed instructions to permit effective operation, maintenance and repair.

.4 Technical data:
.1 Schematic diagram of components, controls and relays.
.2 Illustrated parts lists with parts catalogue numbers.
.3 Certified copy of factory test results.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in

original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect transfer switches from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 EQUPMENT

.1 ATS-1: Service Entrance Rated Automatic Transfer Switch:
.1 400A, 120/240V split single phase 2-pole service entrance rated disconnect and breaker
.2 22,000A withstand rating
.3 2-pole open transition contactor type transfer switch
.4 Of same manufacturer as standby generator and matched to generator model
.5 5-year manufacturer warranty
.6 Four 24 VAC HVAC normally-closed relay load management modules

.2 LMM: Load management modules
.1 Contactor type, normally closed
.2 Minimum 50A rating, and not less than feeder breaker ampacity
.3 240V
.4 Onboard controller monitors generator output frequency
.5 Selectable recovery priority 1-8
.6 Selectable “lockout load on generator” switch

.3 ATS-2: Automatic load transfer switch:
.1 Minimum 50A, 240V
.2 Two 2-pole open transition contactor type transfer switch
.3 12 VDC contactor
.4 Of same manufacturer as ATS-1.

2.2 MATERIALS

.1 Instrument transformers: to CAN/CSA-C60044-1.

.2 Contactors: to NEMA ICS-2.

2.3 CONTACTOR TYPE TRANSFER EQUIPMENT

.1 Contact Type Transfer Equipment: to CSA C22.2 No.178.1.

.2 Two 2-pole contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, motor solenoid operated, open type with CSA enclosure.

.3 Rated:
.1 ATS-1: Service entrance rated with main breaker, 240V, 60Hz, 400A. 3-wire, solid neutral.
.2 ATS-2: 240V, 60Hz, 50A minimum. 3-wire, solid neutral.

.4 Main contacts: silver surfaced, protected by arc disruption means.

.5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.

.6 Fault withstand rating:
.1 ATS-1: 22 kA symmetrical.
.2 ATS-2: minimum 10 kA symmetrical.

.7 Lever to operate switch manually when switch is isolated.

.8 Neutral bar, solid switch rated: 400A.

.9 Overlapping neutral contacts on contactor type transfer equipment.

2.5 CONTROLS

.1 ATS-1:
.1 Controls within generator enclosure.
.2 Transfers to standby upon low-voltage signal from generator.
.3 Generator monitors for utility dropout and pickup.
.4 Adjustable timer to generator start.
.5 Engine warm-up delay.
.6 Re-transfer time delay.
.7 Engine cool-down timer.
.8 Exerciser, selectable interval.
.9 24 VAC HVAC normally-closed relay load management modules in series with identified thermostat’s cooling control signal circuit. When overload condition occurs, management modules interrupt the thermostats’ call for cooling. Modules will recover from load shedding in priority sequence 1-4.

.2 LMM:
.1 Independent controllers within each module
.2 Modules assess overload condition on the basis of frequency drop. When generator frequency drops below 58 Hz for 3 seconds or less, or below 50 Hz for 0.5 seconds, all managed 24 VAC and line-voltage loads will be shed. Loads will remain shut down for a period of 5 minutes. After shutdown due to overload, loads shall attempt to resume sequentially in assigned priority sequence, with 15 second delay between each as follows:

Priority	Recovery Time
1	5 minutes
2	5 minutes 15 seconds
3	5 minutes 30 seconds
4	5 minutes 45 seconds
5	6 minutes
6	6 minutes 15 seconds
7	6 minutes 30 seconds
8	6 minutes 45 seconds

.3 Priority levels are assigned at each module.
.4 Module shall be assigned the following priorities for recovering after a load shedding event:

.1 HP-01 CO Office 205
.2 -03 Multipurpose/Training Room 201
.3 -02 Engineer's Office 203
.4 HP-06 Fitness Room 104
.5 Stove fed from PP-2C1
.6 Hoop House Distribution Panel
.7 Dryer #1 fed from PP-2C1
.8 Main Domestic Water Tank

5. The following modules shall have loads locked out on generator power:
.1 Garage Electric On-demand Water Heater
.2 Dryer #2 fed from PP-2C1

6. Modules shall be wall mounted and physically grouped within the Main Electrical Room or the LQ Mechanical Room

.3 ATS-2:
.1 No controls. Control circuit is managed by solar package inverter. Refer to Section 48 14 00.

2.6 ACCESSORIES

.1 ATS-1:
.1 Auxiliary relay to provide N.O. and N.C. contacts for remote alarms.

.2 ATS-2:
.1 Solar package inverter "generator start" relay does not provide control circuit power. Provide control circuit power matched to ATS contactor: 120V primary Class 2 transformer powered from generator battery charger circuit, secondary AC/DC voltage matched to ATS contactor.

2.7 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Control panel:
.1 For selector switch and manual switch: size 4 5 nameplates.
.2 For meters, indicating lights, minor controls: use size 3 nameplates.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for transfer switches installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Locate, install and connect transfer equipment as indicated.

.2 Check relays solid state monitors and adjust as required to ensure correct operation.

.3 Install and connect battery and remote alarms.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Energize transfer equipment from normal power supply.

.3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.4 Set selector switch in "Manual" position and check to ensure proper performance.

.5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.

.6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and

frequency, and then load should transfer to standby. Allow to operate for 10 minutes, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials, components, cabinets, instruments and installation for digital metering system.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)
.1 ANSI C39.1-1981(R1992), Requirements, Electrical Analog Indicating Instruments. (Withdrawn)

.2 Institute of Electrical and Electronics Engineers (IEEE)
.1 IEEE C37.91-2008, Guide for Protecting Power Transformers.

.3 Canadian Standards Association, (CSA International)
.1 CSA-C17-M84(R2020), Alternating - Current Electricity Metering.
.2 CAN/CSA-C22.2 NO. 61010-1-12(R2017), Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements (Adopted IEC 61010-1:2001, MOD) (Tri-National standard, with UL 61010-1 and ANSI/ISA 61010-1 (82.02.01)).

.4 International Standards Organization (ISO)
.1 ISO 9002:2016, Quality Assurance Standard.

.5 Canadian Electrical Code, CSA C22.1-18.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate meter, instrument, outline dimensions, panel drilling dimensions and include cutout template.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 METER

.1 Meter: Measurement Canada Revenue approved. Certified to CAN/CSA-C22.2 No. 61010-1. All inputs pass IEEE C37.91 surge withstand and fast transient tests Manufactured under ISO 9002.

.2 Kilowatt-hour energy meter: to CSA-C17.

.3 Combination energy and demand meter: to CSA-C17.

2.2 DMS SYSTEM

.1 DMS shall be a true RMS, bi-directional, four quadrant meter capable of measuring, calculating and directly displaying on the front panel display the following information in user programmable groups.
.1 Voltage, Current, kW, kVAR, kVA Power Factor, harmonics, demand, minimums and maximums for each phase and totals for all phases. KWh, kVARh, kVAh totals for all phases. Voltage and current unbalance, frequency, k-factor.
.2 Harmonic distortion for each voltage and current input, up to the 15th harmonic.

.2 DMS shall:
.1 Perform continuous true RMS measurement based on 64 samples-per-cycle sampling on all voltage and current signals.
.2 Readings shall be updated once per second.
.3 Require no PTs on voltage inputs for Delta or Wye (Star) systems up to 600 VAC.
.4 Retain all setup data in non-volatile memory (NVRAM).
.5 Voltage sag detection on any channel for power quality disturbance. Record voltage and current waveforms simultaneous either on alarm condition or on a user defined trigger.
.6 Include 512 kB of non-volatile memory with four fully programmable 16 channel data recorders.
.7 Support multiport communications that provides two ports for RS-485 communications. Interface via ION, DNP3.0, Modbus TCP and Modbus RTU protocols, through serial or Ethernet communications.
.8 Include 10BaseT Ethernet communications port and Ethergate networking capabilities
.9 Have an on-board WebMeter.
.10 Provide setpoint control to four digital output relays.

2.3 SHOP INSTALLATION

.1 Install meters and instrument transformers in separate compartment of switchboards and panelboards as indicated.

.2 Install instruments on panelboards and switchboards.

.3 Ensure adequate spacing between current transformers installed on each phase.

.4 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

PART 3 - EXECUTION

3.1 METERING INSTALLATION

.1 Install meters and instruments in location free from vibration and shock.

.2 Make connections in accordance with diagrams.

.3 Connect meter and instrument transformer cabinets to ground.

.4 Locate meters within 9 m of instrument transformers. Use 32 mm (1-1/4") conduit for interconnections. Use separate conduit for each set of current transformer connections, exclusive for metering.

.5 Perform all power supply and communications wiring connections in accordance with the guidelines set out in the product documentation.

.6 Make all voltage sensing connections to digital meter with 2A fuses.

.7 Install appropriately sized current transformers on each phase with CT shorting blocks in accordance with the Canadian Electrical Code, CSA C22.1.

.8 Install DMS as indicated.

3.2 FIELD QUALITY CONTROL

.1 Conduct tests in accordance with Section 26 05 00 and in accordance with manufacturer's written recommendations.

.2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Perform tests to obtain correct calibration.

.5 Do not dismantle meters and instruments.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Institute of Electrical and Electronics Engineers (ANSI/IEEE)
.1 IEEE C62.41.1-2002(R2008), Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.
.2 CSA C222.2 250.13 LED Equipment

.2 ASTM International Inc.
.1 ASTM F1137/1137M-19, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.3 ICES-005 (December 2018), Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
.3 Photometric data to include: VCP Table where applicable.

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00.
.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return of pallets and packaging materials in accordance with Section 01 74 20.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts.

PART 2 - PRODUCTS

2.1 LAMPS

.1 As indicated in the luminaire schedule.

2.2 DRIVERS

1. LED drivers shall be electronic, labeled as compliant with radio frequency interference (RFI) requirements of FCC title 47 part 15, comply with NEMA SSL 1, have a sound rating of "a" and be rated for a THD of less than 20 percent at all input voltages.
2. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.
3. Drivers shall be rated for the ambient temperatures in which they are located. Outdoor fixtures shall be equipped with ballasts or drivers rated for reliable starting to -20 degrees f. Indoor fixtures located in areas with direct sunlight or above normal ambient temperatures shall have ballasts or drivers rated at 65 degrees C minimum.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule on drawings.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated on drawings.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:
.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
  .1 CSA C22.2 No.141-15(R2020), Emergency Lighting Equipment.
  .2 CSA C22.2 No.250.13:20 Light Emitting diode (LED)

1.2 ACTION AND INFORMATIONAL

.1 Submit in accordance with Section 01 33 00.

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.5 DELIVERY STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
  .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated
  area.
  .2 Store and protect emergency lighting from nicks, scratches, and blemishes.
  .3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 20.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 20.

1.6 WARRANTY

.1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty with a life expectancy of 120 months (10 years).

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, AC.

.3 Output voltage: 6 12 24 V DC.

.4 Operating time: 30 minutes.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads: integral on unit remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: quartz halogen LED, 12 W, minimum 200 lumen minimum output.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: to match existing.

.13 Auxiliary equipment:

- .1 Test switch.
- .2 Time delay relay.
- .3 Battery disconnect device.
- .4 AC input and DC output terminal blocks inside cabinet.
- .6 Cord and single twist-lock plug connection for AC.
- .7 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34.

.2 Conductors: RW90 type in accordance with Section 26 05 21, sized as indicated in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74.00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74.00.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.141-15(R2019), Emergency Lighting Equipment.
.2 CSA C860-11(R2016), Performance of Internally Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)
.1 NFPA-101-2018, Life Safety Code.

.3 Underwriters Laboratories of Canada (ULC)
.1 CAN/ULC-S572-17, Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems.

.4 National Research Council of Canada
.1 National Building Code of Canada (NBC) 2015.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS SDS - Safety Data Sheets.

.4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.
.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.5 Submit manufacturer's written material warranty for the 12 months warranty period prescribed in subsection GC 3.13 of General Conditions is extended to 25 years.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: Die-cast aluminum semi-recessed back box for mounting on ceiling and/or wall.

.3 Face and back plates: Clear acrylic panel with pictogram legend.

Provide pictogram green exit signs to meet NBC requirements.

.4 Lamps: one strip LED-2.5W module 120V, 50,000 hours.

.5 Operation: designed for 50,000 hours of continuous operation without relamping.

.6 Downlight: translucent acrylic in bottom of unit.

.7 Face plate to remain captive for relamping.

.8 Arrow: See drawing for detail.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

.3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74.00.

.2 Clean photoluminescent sign face with a non-abrasive cloth dampened with water. Do not use any chemical solvents.

.3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Provide a communications bonding and grounding system as described in this document, documents and drawings specific to that project, and in compliance with the cited Codes, Standards and Agencies. Such system shall allow for the safest and best way to protect the telecommunications system and equipment.

.2 The bonding and grounding systems within the building will have one electrical potential for the safety of people and equipment throughout the facility.

.3 Whereas the primary purpose of the electrical grounding system is safety, the telecommunication’s grounding system is intended to provide enhanced equipment protection and system performance.

.4 Comply with the requirements for Section 26 05 27 GROUNDING – PRIMARY and 26 05 28 – GROUNDING - SECONDARY.

1.2 REFERENCES

.1 C22.2 No. 41-13 (R 2017) - Grounding and bonding equipment.

.2 J-STD-607-A-2002 - Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications.

.3 ANSI/TIA-607-D (R2019) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

.4 ANSI/TIA-569-E (R 2019)- Telecommunications Pathways and Spaces.

.5 ANSI/TIA-606-C (R2017) Administration Standard for Telecommunications Infrastructure.

.6 IEEE STD 1100-2005 Recommended Practice for Powering and Grounding Electronic Equipment (Emerald Book)

- .1 Ontario Electrical Safety Code 2018 (27th edition).
- .2 Canadian Electrical Code 2018 (24th edition).
- .3 Ontario Building Code 2012.
- .4 National Building Code 2015.
- .5 Local Codes & Bylaws.
- .6 BICSI requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 All grounding and bonding products specified in this section shall be by communications manufacturers, and shall meet all applicable codes and standards. Equivalent products may be considered where the Contractor requests approval in writing from the Departmental Representative.

.2 Be made of high conductivity copper and tin plated to inhibit

corrosion.

.3 Come pre-assembled with brackets and insulators attached for quick installation.

.4 Use component labels, sold separately, to identify busbars to meet ANSI/TIA-606-C (R2017), see chart below.

Bar Size	No. of Mounting Positions		Std. Pck. Qty
	6.4 mm (¼") Stud Hole with 16 mm (5/8") Hole Spacing	9 mm (3/8") Stud Hole with 26 mm (1") Hole Spacing	
6.4 x 51 x 305 ¼" x 2" x 12"	12	6	1
6.4 x 51 x 500 ¼" x 2" x 20"	24	6	1
6.4 x 51 x 610 ¼" x 2" x 24"	28	10	1

Part Description	Std. Pkg. Qty.
Label kit includes printed tag and one flame retardant cable tie	1

2.2 MATERIALS

.1 Conduits: In accordance with Section 26 05 34.

.2 Cable trays: In accordance with Section 27 05 28.

.3 Junction boxes and cabinets: In accordance with Section 26 05 31.

.4 Outlet boxes, conduit boxes and fittings: In accordance with Section 26 05 32.

.5 Cover plates: In accordance with Section 26 27 26.

.6 Fish wire: polypropylene type, minimum 9.5 mm (3/8") diameter.

2.3 SUPPORTS

.1 Anchors for hangers must not be drilled into post-tensioned beams under any circumstances.

.2 Hangers & supports shall be sized to accommodate the number of cables in each run. Other hardware such as hammer on clamps, screw on clamps and angled hanger brackets to support the backbone and/or horizontal cabling shall be included.

.3 Additional hangars and/or supports shall be provided for any cable bundles running vertically for a distance greater than 600 mm (2') (e.g. between overhead tray and cabinets/racks).

2.4 CONDUIT

.1 Electrical Metallic Tubing (EMT) of the sizes indicated shall be installed.

.2 Conduit extending from outlet to cable tray/raceway shall be a minimum of 21 mm, (3/4″) unless the cables exceed a 40% fill ratio.

.3 No conduit shall be smaller than 21 mm, (3/4″) unless specifically detailed in this document.

.4 Standard for workstation outlets shall be double gang box with minimum of 25 mm (1″) conduit from outlet to raceway, unless stated otherwise. No more than two - 90° bends, or a maximum of 180 degree bends in total, in conduit between pull points. Provide a pull box for every 30 m (100'ft) of conduit. Pull boxes are not to be used as bends.

.5 Conduits of 50 mm (2") or less to have a bend radius of six (6) times the conduit diameter. A conduit greater than 50 mm (2″) to have a bend radius of ten (10) times the conduit diameter.

.6 All conduits shall be labelled at each end indicating the destination.

.7 Run all conduits parallel or perpendicular to building grid lines.

.8 Slots and sleeves to extend a minimum of 50 mm (2") above the finished floor.

.9 Conduits shall protrude a minimum of 76 mm (3″)into rooms through walls.

.10 Conduits shall not compromise HVAC ducting or sheet metal work.

.11 Electro metallic tubing (EMT) shall conform to CSA C22.2 No.83.

.12 Conduit and wall boxes to be supplied and installed by Electrical Contractor unless expressly requested in this document.

.13 Pull boxes shall not be used as bends/turns

.14 Bush, ream and remove any sharp projections on all conduits. Slots and sleeves to extend a minimum of 5 cm (2") above the finished floor. Firestop all floor and wall slots/sleeves to maintain floor/wall fire rating after installation of all cables.

.15 Conduits shall not compromise any other building systems.

.16 All conduit shall have 3 mm polypropylene, minimum, fish cords installed. Cabling Contractor to restore any pull strings used by contractor for any part of installation of telecommunications cabling system included in this document.

2.5 CONDUIT FASTENING

.1 One hole malleable iron, hot dipped galvanized straps to secure surface

mounted conduits.

.2 Beam clamps to secure conduits to exposed steel members.

.3 Provide 12 gauge galvanized steel channel type supports for two or more conduits on minimum 1500 mm centres. Use suitable conduit clamps in channel.

.4 Threaded rod with a minimum dia. of 6 mm shall be used to support the suspended channels.

2.6 CONDUIT FITTINGS

.1 Fittings manufactured for use with the conduit specified with the same coating as conduit.

.2 Provide insulated throat set screw steel connectors and couplings for all EMT conduits 50 mm (2″) and smaller.

.3 All 100 mm (4″) conduit shall have proper conduit waterfalls installed.

2.7 WIRE MESH CABLE TRAY

.1 Cable trays shall be sized (including 20% growth) as per the drawings and will accommodate all horizontal and/or backbone cabling within the Telecommunications Room as well as entering/exiting the Telecommunications Room.

.2 All material to properly install the cable tray shall be provided. The cable tray system shall accommodate the weight of the horizontal and/or backbone cabling.

.3 Provide horizontal elbows, end plates, vertical risers and drops, tees, wyes, expansion joints and reducers where required.

.4 Ensure wire tray edges do not exert stress on cables where cables change direction in trays.

.5 Provide waterfalls or transitions where cables exit trays in a downward direction (e.g. above cabinets/racks and backboards).

.6 Wire mesh cable tray shall be manufactured from round steel wire that is a minimum of 5 mm (.196″) in diameter. Wires shall be welded at intersections to form a 50.8 mm x 101.6 mm (2″ x 4″) grid pattern. The tray shall be U-shaped with equal height sidewalls.

.7 Individual tray sections will be 3048 mm (10′) long and 457.2 mm (18″), wide. Sidewalls will be 101.6 mm (4″) high.

.8 Wire mesh cable tray will be nickel plated.

.9 Wire mesh cable tray will be UL Classified for grounding purposes.

.10 Provide all components of the tray system (tray, supports, splices, fasteners, waterfalls, and accessories) from a single manufacturer.

.11 Wire mesh cable tray shall be secured to the structural ceiling, building truss system, wall or floor using manufacturer's recommended supports and appropriate hardware as defined by local code or the authority having jurisdiction (AHJ).

.12 When the pathway is overhead, wire mesh cable tray shall be installed with a minimum clearance of 305mm (12") above and below (between tray and top of rack/cabinet) the tray. Leave 305 mm (12") in between the tray and ceiling/building truss structure. Multiple tiers of wire mesh cable tray shall be installed with a minimum clearance of 305 mm (12") in between the trays. When located above an acoustical drop ceiling, wire mesh cable tray shall be installed a minimum of 76 mm (3") above the drop ceiling tiles.

.13 When installed under a raised floor, wire mesh cable tray shall be installed with a minimum 27 mm (1") clearance between the top of the tray and the bottom of the floor tiles or floor system stringers, whichever are lower in elevation. Maintain a 76 mm (3") clearance between trays wherever trays cross over.

.14 Wire mesh cable tray shall be supported every 1524 mm (5') or less in accordance with ANSI/TIA-569-E (R 2019). Supports may be located directly under splices or intersections if recommended by the manufacturer's installation instructions. If supports are not located under splices or intersections, wire mesh cable tray shall be supported within 2' on both sides of every splice or intersection. Support wire mesh cable tray on both sides of every change in elevation.

.15 Secure wire mesh cable tray to each support with a minimum of one fastener. Follow the manufacturers' recommended assembly, splice and intersection-forming practices.

.16 Trays shall be supported by hangars on each side of tray at maximum 1524 mm (5') intervals. Trays shall be supported by hangars within 305 mm (6") of end of tray.

.17 Use installation tools recommended by the manufacturer to field fabricate wire mesh cable tray intersections and changes in elevation. Use side-action bolt cutters with an offset head to cut wire mesh cable tray. Use a bending tool to form the ends of cut sections downward at 90° to allow easy drop-in installation with approved supports.

.18 Wire mesh cable tray shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the wire basket tray and a minimum #6 grounding wire or as recommended by the AHJ. Verify bonds at splices and intersections between individual cable tray sections and supports. Cable pathway shall be electrically continuous through bonding and attached to the TGB.

.19 The quantity of cables within the tray will not exceed a whole number value equal to 50% of the interior area of the tray divided by the cross-sectional area of the cable. Cable fill will not exceed the depth of the cable tray's side rail 51mm, 103mm, 153mm (2", 4" or 6").

.20 The combined weight of cables within the tray will not exceed stated

load capacity in manufacturer's specifications.

.21 Separate different media type within the tray. Treat each type of media separately when determining cable fill limits.

PART 3 - EXECUTION

3.1 Installation

.1 TMGB and TGB shall be installed at rack height. Refer to Electrical drawings for locations.

.2 The Contractor shall ensure that there is complete metal-to-metal contact is made when grounding to painted or powder coated metal surfaces.

.3 A properly sized copper grounding busbar and associated hardware shall be installed in each of the telecommunications spaces by Electrical Contractor. The busbar shall be bonded to a separate permanent and continuous ground throughout the telecommunications room.

.4 A Telecommunications Main Grounding Busbar (TMGB) is to be provided in the SSC Room in the living quarters.

.5 A Telecommunications Grounding Busbar (TGB) shall be provided in each new Telecommunications Room. The TGB shall be mounted on insulated supports on the walls of the SSC Room. The minimum dimensions are to be 53 mm (2″) tall, 300 mm (12″ long and 7 mm (1/4″) thick.

.6 TGB and TMGB shall be drilled to allow use of dual lug grounding connectors.

.7 Grounding & bonding infrastructures installed by the Contractor shall not interfere with the existing grounding practices within the customer premises.

.8 The Contractor shall provide one (1) rack jumper kit for each piece of network equipment as depicted on rack elevation drawings.

.9 The Contractor shall utilize thread forming screws, bonding screws & any other hardware necessary to complete the ground system.

.10 All telecommunications equipment shall be bonded and grounded to the provided grounding system as per J-STD-607-A-2002.

.11 A minimum 3/0 AWG stranded copper conductor shall be used to bond TMGB and TGB

.12 Bonding conductors must not be laid on ceiling tiles. All bonding conductors must be supported for entire run, using separate support than that provided for telecommunications cables.

.13 Install the raceway system, including wire and cable, terminal cabinets, outlet boxes, pull boxes, cover plates, conduit, sleeves and caps, cable trays, miscellaneous and positioning material to constitute a complete system. Co-ordinate with other services.

.14 Conduits shall not have more than 2-90 deg. or equivalent bends (total maximum of 180 degrees) in each run between pull points, with the bending radii not less than ten (10) times the internal conduit dia.

.15 Pull boxes shall be provided in each conduit run of over 33 m (108.3') at not less than 33 m (108.3') intervals.

.16 All material raceways, terminal boards, etc. shall be to the size and number shown and shall also suit the telephone company requirements.

.17 No pull elbows or LB’s are permitted. Only sweep or 90° elbows shall be utilized.

.18 All conduit and sleeve ends shall be fitted with plastic bushings.

.19 Pull boxes shall be provided with hinged access covers. 610 mm X 610 mm (24" x 24") access panels shall be provided where pull boxes are installed in inaccessible ceilings. Pull boxes for vertical conduits shall be installed to provide straight pass through for vertical cables. The size of pull boxes shall be 8 times the size of the inside diameter size of the largest conduit entering the pull box, except pull boxes for 100 mm (4") conduits shall be 762 mm X 610 mm X 152 mm (30" x 24" x 6") in size.

END OF SECTION

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

.1 Provide a complete Telecommunications raceway system consisting of outlet boxes, cover plates, conduits, J-Hook type cable supports, cable tray, pull boxes, sleeves and caps, backboards, fish wires, service poles, and service fittings, required to make a complete and operative system.

.2 The system shall be provided to the requirements of the local telephone company, interconnect company and all other authorities having jurisdiction.

.3 Install the empty raceway system, including pull strings, terminal cabinets, outlet boxes, pull boxes, conduit, sleeves and caps, cable trays, miscellaneous and positioning material to constitute a complete system. Co-ordinate with other services.

.4 Supply all labour, materials, tools and equipment required to complete the installation in accordance with the full intent of the drawings and specifications.

.5 Provide all work in accordance with codes and manufacturers recommendations
All pathways including conduits, innerduct and cable tray shall be installed parallel or perpendicular to building lines.

.6 Cable to be supported by J-Hooks in accessible ceiling spaces only (rooms, corridors, etc.) and by conduit in inaccessible ceiling spaces. All conduit must extend to open ceiling spaces, in walls (rooms, corridors, etc.) to maintain access to cabling.

1.2 RELATED WORKS

.1 ANSI/TIA-569-E (R 2019)- Telecommunications Pathways and Spaces.

.2 J-STD-607-A-2002 - Commercial Building Grounding (Earthing) And Bonding Requirements For Telecommunications.

.3 ANSI/TIA-607-D (R2019) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

.4 C22.2 No. 41-13 (R 2017) - Grounding and bonding equipment.

.5 CSA C22.1:21 Canadian Electrical Code.

.6 ANSI/TIA-606-C (R2017) Administration Standard for Telecommunications Infrastructure

1.3 ACCEPTABLE MANUFACTURERS:

.1 Tray shall be of wire basket tray type.

.2 For the purposes of this specification the Basket tray in the IT Rooms

will be a minimum size of 450mm x 100mm (18″ x 4″). Supports will be as recommended by the tray manufacturer to support the weight of the installed cabling without sagging of the trays over time. Consult manufacturers fill charts for confirmation of tray sizes and submit during shop drawing process

1.4 WIRE MESH CABLE TRAY SUPPORTS

.1 Supports will be sized at minimum to match the width of the wire mesh cable tray that is supported. The support may be wider than wire mesh cable tray.

.2 Support design will allow the support to be placed under a wire mesh cable tray at any point mid-span or directly under a pathway splice or intersection.

.3 Each support will be punched with an alternating round hole-pattern that accepts wire mesh cable tray ends which are formed downward at 90° and self-threading splice plate attachment hardware.

.4 When placed directly under a splice or intersection, the support will allow drop-in attachment of cable tray. Splice hardware will simultaneously splice cable trays and secure wire mesh cable trays to the support.

.5 Supports will be manufactured from steel extrusion and/or sheet.

.5 Wire Mesh Cable Tray Supports will be nickel plated.

1.5 WIRE MESH CABLE TRAY SPLICES AND FASTENERS:

.1 Provide a method of simultaneously splicing, bonding and securing intersecting wire mesh cable tray sections to supports when supports are placed directly under a wire mesh cable tray pathway at a splice point, intersection point, or at the beginning or end of a change in elevation.

.2 Provide a method of splicing and bonding wire mesh cable tray sections together at a splice point or an intersection point that is not located directly over a support.

.3 Provide a method for bonding and securing wire mesh cable tray to supports when supports are placed mid-span (in between a splice or intersection point) along a wire mesh cable tray pathway.

.4 Provide a method for attaching wire mesh cable tray directly to the top of racks and cabinets.

.5 Provide a method for attaching wire mesh cable tray supports to raised floor pedestals.

.6 Provide a method for attaching a bonding conductor to the wire mesh cable tray.

1.6 WIRE MESH CABLE TRAY ACCESSORIES:

.1 Provide a divider to separate cable tray into multiple pathways where required. The divider shall be the same height as the sidewalls of the cable tray.

.2 Provide a bend radius to connect the sidewalls of adjoining wire mesh cable tray wherever a splice or an intersection in the cable tray pathway results in a 100mm (4″) or wider gap between the sidewalls. The bend radius shall be the same height as the sidewalls of the wire mesh cable tray.

.3 Provide a radius drop to form cable over a smooth curve wherever cable exits or enters the side, bottom or end of wire mesh cable tray.

.4 Wire mesh cable tray accessories will be manufactured from steel extrusion and/or sheet.

.5 Wire mesh cable tray accessories will be nickel plated.

1.7 WIRE MESH CABLE TRAY INSTALLATION TOOLS:

.1 Provide specialized cutting and forming tools required for field fabrication of wire mesh cable tray pathways.

.2 Provide specialized tools required for pulling cable around turns, bends or intersections in wire mesh cable tray pathway.

.3 Provide installation hardware to attach wire mesh cable tray supports to building structure.

1.8 HANGERS

.1 Supply and install Caddy hangers, hanger supports and any other miscellaneous hardware required to support telecommunications cabling where conduit/ladder tray has not been provided.

1.9 INNERDUCT FOR FIBRE OPTIC CABLES

.1 Innerduct is to be appropriately rated to comply with fire codes.

.2 Innerduct shall be sized appropriately to maintain the 40% fill ratio.

.3 All fastening hardware is to be included.

.4 Supply and install innerduct any exposed runs (not in conduit) of fibre optic cable.

.5 The innerduct shall be fastened to the building support when installed in the ceiling space.

.6 The innerduct shall be fastened to the backboard, rack or cabinet by utilizing cradle mounts and plastic permanent cable ties.

1.10 EXECUTION

.1 The Pathways for Communications Cabling shall be installed per instructions in this document and in accordance with prevailing

standards and codes.

.2 Identify to site supervisor, and resolve issues with any location where cable pathways fail to meet separation clearances as detailed in this document, prior to start of cable path installation.

.3 Maintain the following clearances from electrical and heat sources when installing conduits for data/telephone cables.

	Minimum Separation Distances		
Item	**(<2kVA)**	**(2-5kVA)**	**(>5kVA)**
Unshielded power lines or electrical equipment in proximity to open or non-metallic pathway.	127 mm (5″)	305 mm (12″)	610 mm (24″)
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	64 mm (2.5″)	152 mm (6″)	305 mm (12″)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway.	64 mm (2.5″)	76 mm (3″)	152 mm (6″)
Motors	1.2 m (4’-0″)		
Transformers	1.2 m (4’-0″)		
Conduit and cables used for electrical distribution less than 1kV	0.3 m (1’-0″)		
Conduit and cables used for electrical distribution greater than 1kV	1.0 m (3’-0″)		
Fluorescent Luminaires	300 mm (12″)		
Pipes (gas, oil, water, etc.)	120 mm (5″)		
HVAC (equipment, ducts, etc.)	150 mm (6″)		
Coax (CATV/CCTV)	Separate conduits or metallic divider in cable tray (do not run Cat6A and coax in same pathways)		

1.11 ELECTRICAL COMMISSIONING

.1 Provide documents, tools, etc. to complete this task.

.2 Arrange for suppliers, manufacturer’s, subcontractors, etc. to perform all the tests identified and document properly as per requirements.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL: General electrical installation requirements.

1.2 REFERENCES

.1 Standards Council of Canada:
.1 CAN/ULC-S524-2019, Standard for Installation of Fire Alarm Systems
.2 CAN/ULC-S531-2019, Standard for Smoke Alarms
.3 CAN/ULC-S537-2019, Standard for Verification of Fire Alarm Systems

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00, SUBMITTAL PROCEDURES and with requirements in the individual specification sections.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for smoke alarm system and include product characteristics.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by Departmental Representative.

.4 Closeout Submittals:
.1 Operation and Maintenance Data: submit operation and maintenance data for smoke alarm system for incorporation into manual.

.5 Maintenance Material Submittals:
.1 Submit maintenance materials in accordance with Section 01 78 00 – CLOSEOUT SUBMITTALS.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:
.1 Store materials indoors in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect materials from nicks, scratches, and blemishes.

PART 2 – PRODUCTS

2.1 DESCRIPTION

.1 A smoke alarm system complete with standalone devices connected such that should any one device being activated all devices in the living quarters shall sound with strobes flashing.

.2 The devices to carry out fire alarm and protection functions; including smoke alarm signals; initiating strobes and sounder alarm.
.3 Devices to include:
.1 Smoke sensor.
.2 Audible and visual signaling smoke alarm.
.2 120V powered unit.
.3 Auxiliary onboard 10-year lithium battery backup.
.4 Wiring.
.4 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
.5 Audible signal devices: to CAN/ULC-S524.
.6 Smoke alarms: to CAN/ULC-S531.
.7 Regulatory Requirements:
.1 Subject to Fire Commissioner of Canada (FC) approval.
.2 Subject to FC inspection for final acceptance.

2.2 ALARMS OPERATION: SINGLE STAGE - SIGNALS ONLY

.1 Actuation of any alarm initiating device to:
.1 Cause audible and visible signaling devices to activate continuously throughout building.

2.3 WIRING

.1 14 AWG copper conductors: rated 120 V.

2.4 AUTOMATIC ALARM INITIATING DEVICES

.1 Smoke Alarm: photo-electric
.1 Twistlock Plug-in type with fixed base.
.2 Wire-in base assembly with integral red alarm LED, and terminals for remote relay.
.2 Variable-sensitivity smoke alarms.
.1 Photo-electric type.

2.5 AS-BUILT WIRING DIAGRAM

.1 Smoke alarm system wiring diagram: to be submitted with shop drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for smoke alarm installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.

3.2 INSTALLATION

.1 Install in accordance with CAN/ULC-S524.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL and CAN/ULC-S537.

.1 Smoke alarm devices:

.1 Test such device and alarm circuit to ensure, smoke alarms are functioning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by fire alarm system installation.

3.5 CLOSEOUT ACTIVITIES

.1 Provide on-site demonstration by smoke alarm equipment manufacturer/installer to train operational personnel in use and maintenance of smoke alarm system.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS.PROV 805, November 2015 - Construction Specification for Temporary Erosion and Sediment Control Measures.

.2 OPSS.PROV 1004, November 2012 - Material Specification for Aggregates - Miscellaneous.

.3 OPSS.MUNI 1010, November 2013 - Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

.4 OPSS.MUNI 1359 November 2016 – Material Specification for Unshrinkable Backfill.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.
.1 Submit sieve analysis for each type and source of granular material

.2 Product Data
.1 Submit manufacturer's instructions, printed product literature and data sheets for aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.

.3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.

.2 Granular “A” maximum size 50mm to OPSS.MUNI 1010.

.3 Granular “B” maximum size 100mm Type I and II to OPSS.MUNI 1010.

.4 Clear Stone to OPSS.PROV 1004.

.5 Sand conforming to gradation requirements of mortar sand to OPSS.PROV 1004.

.6 Unshrinkable fill to OPSS.MUNI 1359.

2.2 SOURCE QUALITY CONTROL

.1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks minimum before starting production.

.2 If materials from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, including the requirements of Subsection 1.9 of Section 01 35 13.43 to locate an alternative source.

.3 Advise Departmental Representative 4 weeks minimum in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for aggregate stockpiling.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with stockpiling of aggregate material only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

.4 Before commencing work verify locations of all buried services on and adjacent to work area. Demark those for which relocation is required. Contractor to co-ordinate relocation with relevant discipline.

3.2 PREPARATION

.1 Stockpiling

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:
.1 Maximum 1.5 m for all materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

.12 Ensure that erosion / sedimentation control measures are taken when stockpiling soils and granular material as per OPSS.PROV 805.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.4 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 OPSS.PROV 180, November 2016 - General Specification for the Management of Excess Material.

.2 OPSS.PROV 201, April 2019 - Construction Specification for Clearing, Close Cut Grubbing and Removal of Surface and Piled Boulders.

1.3 DEFINITIONS

.1 Clearing consists of cutting off trees and brush, vegetative growth to not more than 300mm above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris off site.

.2 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

.3 Tree removal consists of the removal of all trees including the stump and roots to a minimum of 300 mm below finished grade.

1.4 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing structures, utility lines, site appurtenances, water courses, root systems of trees which are to remain.
  .1 Repair damaged items to approval of Departmental Representative.
  .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.
  .3 Limit clearing and grubbing to area at the discretion of Departmental Representative.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect site and verify with Departmental Representative, items designated to remain. No clearing or grubbing is to commence without the approval of Departmental Representative.

.2 Locate and protect utility lines: preserve in operating condition active

utilities traversing site.

.1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.

.3 Notify utility authorities before starting clearing and grubbing.

.4 Keep roads and access free of dirt and debris.

3.2 CLEARING

.1 Clear as indicated on drawings, by cutting at height of not more than 300 mm above ground, in areas to be subsequently grubbed.

.2 Cut off branches and cut down trees overhanging area cleared.

.3 Cut off unsound branches on trees designated to remain.

3.3 GRUBBING

.1 Grub out stumps and roots to not less than 300 mm below ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m2.

.3 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.4 TREE REMOVAL

.1 Remove trees identified for removal to OPSS.PROV 180 and OPSS.PROV 201. Stump to be removed to 300 mm below finished grade. Backfill and compact resulting pits and finish grade as required. In addition to other requirements, backfill must comply with environmental quality requirements in Subsection 1.9 of Section 01 35 13.43.

3.5 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site.

3.6 PROTECTIVE FENCING

.1 All existing trees within the work area which are to remain, shall be fully protected with hoarding, i.e. 1200 mm snow fencing erected beyond their drip line. Groups of trees and other existing plantings to be protected, shall be done in a like manner with hoarding around the entire clump(s). Areas within the protective fencing shall remain undisturbed and shall not be used for the storage of building materials or equipment.

.2 All species at risk within or adjacent to the area of work shall be protected. Species at Risk to be identified by the Departmental Representative at Project commencement.

3.7 STORAGE OF MATERIALS

.1 No rigging cables shall be wrapped around or installed in trees and surplus soil, equipment, debris or materials shall not be placed over root systems of trees within the protective fencing. No contaminants will be dumped or

flushed where feeder roots of trees exist.

3.8 ROOT DAMAGE

.1 Where root systems of protected trees are exposed directly adjacent to or damaged by construction work, they shall be trimmed neatly and the area backfilled with appropriate material to prevent desiccation. In addition to other requirements, backfill must comply with environmental quality requirements in Subsection 1.9 of Section 01 35 13.43.

3.9 SILTATION CONTROL

.1 During construction, the Contractor shall take every precaution to avoid siltation or erosion of undisturbed or adjacent lands, to the approval of the Departmental Representative.

3.10 PRUNING

.1 Selectively remove 1/3 of tree branches to reduce transpiration and compensate for dieback of roots in fill conditions and damage to root system in cut conditions.

.2 Where limbs or portions of trees are removed to accommodate construction work, they will be removed carefully by accepted horticultural practices, and exposed wood treated with an approved tree wound dressing.

3.11 FINISHED SURFACE

.1 Leave ground surface in condition suitable for stripping of topsoil to approval of Departmental Representative.

END

PART 1 - GENERAL

1.01 RELATED SECTIONS

.1 Section 32 16 00 - Curbs, Gutters and Sidewalks.

1.02 REFERENCES

.1 American Society for Testing and Materials (ASTM)
.1 ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

1.03 EXISTING CONDITIONS

.1 Known underground and surface utility lines and buried objects are as indicated on site plan.

1.04 PROTECTION

.1 Protect and/or transplant existing fences, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain and as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

PART 2 - PRODUCTS

2.01 MATERIALS

.1 Fill material: In accordance with Section 31 23 33.01 and Section 01 35 13.43.

PART 3 - EXECUTION

3.01 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Departmental Representative.

.2 Commence topsoil stripping of areas as indicated in the Contract Drawings or as required for Performance of Work after area has been cleared of brush weeds and grasses and removed from site.

.3 Strip topsoil to depths as indicated in the Contract Drawings.

.4 Dispose of topsoil off site in accordance with Section 01 35 13.43.

3.02 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:
.1 100 mm for grassed areas.
.2 As per contract drawings.

.3 Grade swales and ditches to depth as indicated in the Contract Drawings.

.4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.5 In addition to other requirements, fill must comply with environmental quality requirements in Subsection 1.9 of Section 01 35 13.43.

.6 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:
.1 85% under landscaped areas.
.2 95% under paved and walk areas.

.7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.03 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by Departmental Representative. Costs of tests will be paid by Departmental Representative. Refer to Section 01 45 00.

3.04 SURPLUS MATERIAL

.1 All stripped and excavated material is to be removed for off-site disposal and not reused on-site.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
.1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).

1.2 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
.1 Rock : solid Material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m² bucket. Frozen Material not classified as rock.
.2 Common excavation: excavation of Materials of whatever nature, which are not included under definitions of rock excavation.

.2 Topsoil:
.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable Material larger than 25 millimeters in any dimension.

.3 Waste material: excavated Material unsuitable for use in Work or surplus to requirements.

.4 Borrow Material: Material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.5 Recycled fill Material: Material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.6 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00.

.2 Quality Control: in accordance with Section 01 45 00:
.1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
.2 Submit for review by Departmental Representative proposed dewatering methods as described in PART 3 of this Section.
.3 Submit to Departmental Representative written notice at least 7 days prior to excavation Work, to ensure cross sections are taken.

.4 Submit to Departmental Representative written notice when bottom of excavation is reached.
.5 Submit to Departmental Representative testing and inspection results and report as described in PART 3 of this Section.

.3 Preconstruction Submittals:
.1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
.2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field.

1.4 QUALITY ASSURANCE

.1 Do not use soil Material until written report of soil test results are reviewed by Departmental Representative.

.2 Health and Safety Requirements: Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse and recycling in accordance with Section 01 74 20.

.2 Surplus soils to be disposed of off-site, in a licensed landfill.

1.6 EXISTING CONDITIONS

.1 Buried services:
.1 Before commencing Work verify location of buried services on and adjacent to site.
.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of Work: pay costs of relocating services.
.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
.5 Prior to beginning excavation Work, notify Departmental Representative and applicable authorities having jurisdiction, establish location and state of use of buried utilities and structures. Departmental Representative and authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
.6 Confirm locations of buried utilities by careful test excavations.
.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
.8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
.9 Record location of maintained, re-routed and abandoned underground lines.
.10 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

.3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Aggregate Materials: In accordance with Section 31 05 16.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of Authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly in accordance with Section 02 41 13.14

3.3 PREPARATION/PROTECTION

.1 Protect existing features in accordance with Section 01 56 00 and applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

3.4 STOCKPILING

.1 Stockpile fill Materials in areas designated by Departmental Representative in accordance with Section 01 35 13.43.
.1 Stockpile granular Materials in manner to prevent segregation.

.2 Protect fill Materials from contamination.

.3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.5 DEWATERING

.1 Keep excavations free of water while Work is in progress.

.2 Provide for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with Section 01 35 13.43.
.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.6 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated.

.2 Remove concrete, masonry, paving, walks, and other obstructions encountered during excavation in accordance with Section 02 41 13.14.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Keep Materials safe distance away from edge of trench as directed by Departmental Representative.

.7 Restrict vehicle operations directly adjacent to open trenches.

.8 Dispose of excavated Material in accordance with Section 01 35 13.43.

.9 Do not obstruct flow of surface drainage or natural watercourses.

.10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.11 Notify Departmental Representative when bottom of excavation is reached.

.12 Obtain Departmental Representative approval of completed excavation.

.13 Remove unsuitable Material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.14 Correct unauthorized over-excavation as follows:
.1 Fill under bearing surfaces and footings with concrete specified for footings.
.2 Fill under other areas with granular Material indicated compacted to not less than 95% of corrected Standard Proctor maximum dry density.
.3 In addition to other requirements, fill must comply with environmental quality requirements in subsection 1.9 of Section 01 35 13.43.

.15 Hand trim, make firm and remove loose Material and debris from excavations.
.1 Where Material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
.2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.7 COMPACTION

.1 Use types of fill as indicated. Compaction densities are percentages of maximum densities obtained from ASTM D698.
.1 Exterior side of perimeter walls: fill to subgrade level. Compact to 95% of corrected maximum dry density.
.2 Within building area: fill to underside of base course for floor slabs. Compact to 100% of corrected maximum dry density.
.3 Under concrete slabs: provide 150 mm compacted thickness base course to underside of slab. Compact base course to 100%.
.4 Place unshrinkable fill in areas as indicated.

3.8 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular Material for bedding and surround of underground services as indicated.

.2 Place bedding and surround Material in unfrozen condition.

3.9 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:
.1 Departmental Representative has inspected and approved installations.
.2 Departmental Representative has inspected and approved of construction below finish grade.
.3 Inspection, testing, approval, and recording location of underground utilities.
.4 Removal of concrete formwork.
.5 Removal of shoring and bracing; backfilling of voids with satisfactory soil Material.
.6 Backfill Material quality has been approved by Departmental Representative in accordance with Section 01 35 13.43.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill Material which is frozen or contains ice, snow or debris.

.4 Place backfill Material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations:
.1 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
.2 Place layers simultaneously on both sides of installed Work to equalize loading.
.3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative or:
.2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.

.6 Place unshrinkable fill in areas as indicated.

.7 Consolidate and level unshrinkable fill with internal vibrators.

3.10 RESTORATION

.1 Upon completion of Work, remove waste Materials and debris in accordance to Section 01 74 20, trim slopes, and correct defects as directed by Departmental Representative.

.2 Place new topsoil as indicated.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

.5 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00: Concrete Reinforcing.

.2 Section 03 30 00: Cast in Place Concrete.

.3 Section 31 23 33.01: Excavating, Trenching and Backfilling.

1.2 REFERENCE STANDARDS

.1 All referenced standards to be the current edition or the edition referenced by the 2015 National Building Code.

.2 Canadian Standards Association (CSA International):
.1 CSA A23.1:19/A23.2:19, Concrete materials and methods of concrete construction / Test methods and standard practices for concrete.
.2 CSA G40.20-13/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.3 CSA S16-14:19, Limit States Design of Steel Structures.
.1 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
.2 W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
.3 W59-18, Welded Steel Construction (Metal Arc Welding).

.3 ASTM International Inc.:
.1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
.2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot Dip Galvanized) coating on Iron and Steel Products
.3 ASTM F3125/F3125M-19, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPA) Minimum Tensile Strength, Inch and Metric dimensions
.4 ASTM A500/A500M-20, Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

.4 Canadian Geotechnical Society:
.1 Canadian Foundation Engineering Manual.

.5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:
.1 SSPC-SP 1, Solvent Cleaning.
.2 NACE No. 3 / SSPC-SP 6, Commercial Blast Cleaning.
.3 NACE No.4 / SSPC-SP 7, Brush Off Blast Cleaning.
.4 NACE No.2 / SSPC-SP 10, Near White Blast Cleaning.
.5 SSPC Technology Guide No.14 – Guide for the Repair of Imperfections in Galvanized, Organic or Inorganic Zinc-Coated Steel Using Organic Zinc Rich Coating.
.6 SSPC Paint Specification No. 20 – Zinc Rich Coating, Type I –

Inorganic and Type II - Organic.

1.3 QUALITY ASSURANCE

.1 Qualifications:
.1 Contractor installing helical piles to be certified by the supplier.
.2 Welding to be performed by a firm certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2.
.3 Welders to be CWB approved.
.4 Engage a Professional Engineer licensed in the place where the project is located to be responsible for design, detailing, testing, and installation of all helical piles.

1.4 QUALITY CONTROL

.1 Submit in accordance with Section 01 45 00.

.2 Source Quality Control Submittals:
.1 Submit mill test reports showing chemical and physical properties of helical piles to be incorporated in the project.

.3 Tolerances:
.1 Maximum deviation at cut-off elevation from position on plan: 65 mm (2½")
.2 Maximum deviation from cut-off elevation: +12 mm, -50 mm (+½", -2")
.3 Maximum deviation from plumb: 2%
.4 Projection over legal boundary: zero

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Submit procedures and list of equipment to be used for installation, including calibration reports.

.3 Submit load testing procedure, including list of equipment to be used for testing and calibration records.

.4 Shop Drawings:
.1 Provide drawings stamped and signed by a Contractor's Professional Engineer responsible for design of helical piles.
.2 When requested, submit sketches and design calculations stamped and signed by Engineer.
.3 Show on drawings:
.1 Helical piles types, sizes and layouts.
.2 Design loads, ULS and SLS pile capacities.
.3 Expected total and differential settlements.
.4 Material specifications.
.5 Size of pile shaft and number and diameter of helical

plates.
.6 Minimum effective installation torque.
.7 Inclination.
.8 Cut off elevation.
.9 Details of attachment to structure.

.5 On completion of installation, provide a letter signed and sealed by the Professional Engineer responsible for helical piles stating that each pile will be capable of developing the required load capacity without excessive settlement.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Design helical piles and their anchorage using Limit State Design approach, in accordance with the governing National Building Code, CSA A23.3, CSA S16 and Canadian Foundation Design Manual, to be capable of safely carrying the loads shown on drawings without excessive settlements, max 20mm. Use Geotechnical Resistance Factor in line with the method used to determine the ultimate geotechnical resistance.

.2 Establish pile length and refusal criteria necessary to achieve the specified capacity.

.3 Specify performance and/or proof load testing procedure and acceptance criteria to confirm design assumptions. A testing program for helical piles subject to tension is mandatory.

.4 If requested, provide signed and sealed design calculation.

.5 If the pile supplier’s design requires modifications of any other elements shown on design drawings (such as pile caps), the pile supplier will be responsible for all associated modification costs of design and construction.

2.2 MATERIALS

.1 Helical pile shafts, blades and accessories: to CSA G40.20/G40.21, hot dip galvanized per ASTM A123/A123M.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

.1 Determine any potential interference with existing services and protect from disruption and damage

.2 Protect existing structure from damage.

.3 If the site is underlain by variable fill known to generate explosive gases, refer to Division 1 for safety requirements.

3.2 FOUNDATION CONDITIONS

.1 A final Geotechnical Report has been prepared for the Project by Englobe, report No: 124-B-0017786-0-01-100-GE-R-001, Search and Rescue Station (SAR) Revitalisation, St. Catharines, ON., dated October 16, 2019, and the supplementary geotechnical investigation report No: 124-B-0017786-0-01-100-GE-R-0002-01 Search and Rescue Station (SAR) Revitalisation, St. Catharines, ON., New Garage, dated July 21, 2020.

.2 The Geotechnical Report is not represented as a complete description of site conditions but only as to what was found in borings at indicated locations. The Owner, and Departmental Representatives assume no responsibility for any interpretation or deduction that the Contractor may make from the data. The Contractor to establish the nature of observable conditions to his own satisfaction and has the right to obtain additional information, if necessary, in his judgment.

.3 Departmental Representative will conduct inspection during installation of helical piles in accordance with Section 01 45 00.

.4 Notify Departmental Representative if subsurface conditions are found to differ materially from those indicated in the Contract Documents or geotechnical report.

3.3 OBSTRUCTIONS

.1 Obstructions may be encountered during installation of helical piles.

.2 All obstructions are to be confirmed by the Departmental Representative track and certify the time required for obstruction removal.

.3 Have all the equipment required to do this work readily available for the duration of the pile installation.

.4 Delay time resulting from not having the required equipment readily available, or from breakdown of the equipment will be at the cost of the Contractor.

.5 Repair and replacement costs for damaged equipment shall not be considered extras.

.6 The time required for obstruction removal cannot be claimed to extend the overall construction schedule.

3.4 INSTALLATION

.1 Do not install helical piles anchors unless the Departmental Representative is present.

.2 Do not damage adjacent structures. Make good any damage caused by pile installation and operations.

.3 Hold piles securely and accurately in position while installing and

apply sufficient down pressure to advance them. Install in a smooth, continuous manner.

.4 Prevent load transfer between soil and the portion of the piles above the level of the competent soil to be used for bearing by providing bitumen coating or permanent smooth sleeves.

.5 Provide plain extension material as required to advance piles to the required depth. Extensions to be coupled to helical pier using high strength structural bolts.

.6 Monitor installation torque throughout the installation process.

.7 Terminate pile installation when the minimum installation torque and the minimum depth requirements are satisfied. Record termination torque.

.8 If the minimum torque requirement has not been satisfied at a pile's minimum depth level, the contractor has the following options:
.1 To advance the pile deeper using additional plain extension material until the specified torque level is obtained.
.2 To remove the pile and to install another pile with larger and/or more helices. This revised pile to be installed at least 900 mm (3') beyond the termination depth of the original pile.
.3 To propose installation of additional piles and submit for Departmental Representative review.

.9 If the maximum torque rating of a pile and/or the installing unit is reached prior to satisfying the minimum depth requirement, remove the pile and install another pile with smaller and/or fewer helices. The revised pile to be installed at least 900 mm (3') beyond the termination depth of the original pile.

.10 Cut-off piles neatly and square at elevations indicated.

.11 Connect piles to structure using steel brackets or end plates per capable of safely transferring the structural loads to the pile.

.12 Touch up all cuts, drills welds and other damage to galvanizing with Zinc Rich paint in accordance to SSPC Technology Guide No. 14.

.13 Keep accurate records and submit to Departmental Representative at the completion of installation. Records to include:
.1 Deviation from specified location and plumb.
.2 Type of installation equipment used.
.3 Installation torque measured at 300 mm (1') increments.
.4 Bottom elevation and cut off elevation.
.5 Ground surface elevation
.6 Load testing results.

.14 As an alternative to the submission of a full set of records, the Contractor may certify the records of the Inspection and Testing Agency and submit only the information not included in those records.

3.5 FIELD QUALITY CONTROL

.1 Refer to Section 01 45 00.

.2 Perform load tests as required to confirm tension pile capacities. Test 10% of the installed piles.

.3 If a pile fails the load test, modify installation procedures as required to achieve the specified capacity and repeat the test. Submit proposal for the remedial work necessary to allow piles already installed to carry their specified load for Departmental Representative approval.

3.6 INSPECTION AND TESTING

.1 An Inspection and Testing Agency will be appointed to check pile length refusal criteria, to review the proposed pile load testing procedures and acceptance criteria, and to observe and document installation and load testing of helical tension piles on a full-time basis.

.2 Assist the Departmental Representative parties to the contract in its work. Notify as to the Work Schedule and provide safe access to the work area as required.

.3 The Agency will submit reports covering the work inspected and the testing performed.

.4 The Agency will keep accurate records of the construction of each pile and submit to Departmental Representative at the completion of the piling operation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

.2 Ontario Provincial Standard Specifications (OPSS)
  .1 OPSS.PROV 1010, April 2013 - Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Granular A material (19mm max) as per OPSS.PROV 1010.

PART 3 - EXECUTION

3.1 PLACING

.1 Place on a clean surface, properly shaped and compacted and free from snow or ice.

.2 Place material in layers not exceeding 150 mm when compacted.

.3 Spread each layer uniformly using approved grading equipment and methods to depths and grades indicated in the Contract Drawings.

3.2 COMPACTING

.1 Compact each layer to minimum 100% Standard Proctor Maximum Dry Density to ASTM D698.

.2 Add water as required to maintain material at or near optimum moisture content while compacting.

3.3 FIELD QUALITY CONTROL

.1 The Departmental Representative will perform field and laboratory tests for control of moisture, density and aggregate gradation. Results will control Contractor's operations.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM C136/C136M - 19 Standard Test Method for Sieve Analysis

.2 Ontario Provincial Standard Specification (OPSS):
  .1 OPSS.PROV 1010 November 2013, Material Specification for Aggregates, Base, Subbase, Select Subgrade, and Backfill Material.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Granular Sub-base: Granular B, Type 1 as per OPSS.PROV 1010.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Graduation of stone materials will be performed in accordance with ASTM C136/C136M.

.2 Granular base: Granular A material (19mm max) as per OPSS.PROV 1010.

.3 Granular Sub-base: Granular B, Type 1 as per OPSS.PROV 1010.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

.1 Placing
  .1 Construct granular base and sub-base to depth and grade in areas indicated on the Contract Drawings.
  .2 Ensure no frozen material is placed.
  .3 Place material only on clean unfrozen surface, free from snow and ice.
  .4 Place material using methods which do not lead to segregation or degradation of aggregate.
  .5 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
  .6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
  .7 Remove and replace that portion of layer in which material becomes segregated during spreading.

.2 Compaction Equipment
  .1 Compaction equipment to be capable of obtaining required material densities.

.3 Compacting
.1 Compact to density not less than 100% SPMDD.
.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
.3 Apply water as necessary during compacting to obtain specified density.
.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.2 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

3.4 QUALITY CONTROL

.1 Perform QC testing as per Section 01 45 00 by Departmental Representative.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
.1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

.2 Ontario Provincial Standard Specifications (OPSS)
.1 OPSS.PROV 1010, April 2013 - Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Granular B Type I: to OPSS.PROV 1010. Maximum size Granular B Type I, 75.0 mm.

PART 3 - EXECUTION

3.1 PLACING

.1 Place on a clean surface, properly shaped and compacted and free from snow or ice.

.2 Place material in layers not exceeding 200 mm when compacted.

.3 Spread each layer uniformly using approved grading equipment and methods to depths and grades indicated in the Contract Drawings.

3.2 COMPACTING

.1 Compact each layer to minimum 100% Standard Proctor Maximum Dry Density to ASTM D698.

.2 Add water as required to maintain material at or near optimum moisture content while compacting.

3.3 FINISHING

.1 Finish compacted surface to within 12mm of established grade as indicated by a 3m straightedge placed in any direction.

.2 Correct irregularities greater than 12mm by loosening the surface and adding or removing material until surface is within specified tolerance.

3.4 FIELD QUALITY CONTROL

.1 The Departmental Representative will perform field and laboratory tests for control of moisture, density and aggregate gradation. Results will control Contractor's operations.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.5-M91(March 1999), Low Flash Petroleum Spirits Thinner (Reaffirmation of December 1991).
- .2 CGSB 1-GP-12c-1983, CGSB 1-GP-12c-1983.

.2 Manual of Uniform Traffic Control Devices for Ontario (MUTCD)

.3 Ontario Provincial Standard Specifications (OPSS)
- .1 OPSS.MUNI 310, November 2017, Construction Specification for Hot Mixed Asphalt.
- .2 OPSS 710, November 2010, Construction Specification for Pavement Markings.
- .3 OPSS.MUNI 1006, November 2013, Material Specification for Aggregates - Surface Treatment.
- .4 OPSS.PROV 1103, November 2016, Material Specification for Emulsified Asphalt.
- .5 OPSS 1150, November 2018, Material Specification for Hot Mixed Asphalt.
- .6 OPSS 1712, February 1991, Organic Solvent Based Traffic Paint.
- .7 OPSS 1750, December 1983, Material specification for Traffic Paint Reflectorizing Glass Beads.
- .8 OPSS.PROV 341, April 2018, Construction Specification for Routing and Sealing Cracks in Hot Mix Asphalt Pavement.

.4 Designated Sources for Material - Ontario Ministry of Transportation.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit to Departmental Representative, the asphalt mix design at least 2 weeks before paving work.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Prime coat: SS-1 to OPSS.PROV 1103.

.2 Tack coat: SS-1 to OPSS.PROV 1103.

.3 Organic solvent based pavement marking material shall be as per OPSS 1712, Standard Paint Colours in accordance with CGSB 1-GP-12c. Submit samples in accordance with OPSS 710.

.4 Traffic Paint Reflectorizing Glass Beads shall be as per OPSS 1750.

.5 Asphalt concrete: to OPSS.MUNI 310.
.1 HL3 (50mm), 100% crushed virgin material for coarse and fine aggregates, coarse aggregate size 100% 16.0mm.

.2 HL8 (50mm), coarse and fine aggregates meeting physical and gradation specification, coarse aggregate size 100% 26.5mm.

.6 Paint thinner: to CAN/CGSB-1.5.

.7 RS-1 Rapid Set Emulsion to OPSS.PROV 1103.

.8 Surface Treatment Aggregate: Class 5 to OPSS.MUNI 1006.

.9 Refer to Search and Rescue Station (SAR) Revitalization. St. Catharines, ON. Final Geotechnical Investigation Report. Prepared by Englobe, date October 16, 2019 included in Appendix A.

.10 Refer to Search and Rescue Station (SAR) Revitalization. St. Catharines, Ontario – New Garage. Supplementary Geotechnical Investigation, 124-B0017786-0-01-100GE-R0002-01. Prepared by Englobe dated July 21, 2020 included in Appendix A.

PART 3 - EXECUTION

3.1 PAVEMENT THICKNESS

.1 Pavements for roadways: As per Contract Drawings.

3.2 PAVEMENT CONSTRUCTION

.1 Application of Prime coat: SS-1 to OPSS.PROV 1103. Apply on granular base.

.2 Application of tack coat: OPSS.PROV 1103. Apply only on clean and dry surface. Paint contact surfaces of curbs, gutters, manholes and like structures with thin, uniform coat of asphalt tack coat material.

.3 Construction of asphalt concrete: OPSS.MUNI 310.

.4 Refer to Search and Rescue Station (SAR) Revitalization. St. Catharines, ON. Final Geotechnical Investigation Report. Prepared by Englobe, date October 16, 2019 included in Appendix A.

.5 Refer to Search and Rescue Station (SAR) Revitalization. St. Catharines, Ontario – New Garage. Supplementary Geotechnical Investigation, 124-B0017786-0-01-100GE-R0002-01. Prepared by Englobe dated July 21, 2020 included in Appendix A.

3.3 TRAFFIC MARKINGS

.1 Spray equipment shall be used for application of solvent based traffic paint. The spray equipment shall provide a uniform stripe to the required width and thickness, with sharp edges without excessive splatter or overspray. The equipment shall have the capability to provide pavement markings conforming to MUTCD. The equipment shall be provided with glass bead dispenser at the recommended rate. Equipment shall be capable of mixing, maintaining and applying the material at the recommended temperature.

.2 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

.3 The contractor shall provide the necessary measurements required to establish the position of all pavement markings.

.4 The material shall be applied when the pavement surface temperature is 5°C and above.

.5 Paint shall be applied at a rate which results in a uniform thickness of 230 microns ±25microns dry film.

.6 Markings shall not be applied over pavement joints.

.7 Reflective glass beads conforming to OPSS 1750 shall be applied uniformly at a rate of 0.7kg per litre of paint for 40-56% Volume Solids of Traffic Paint, or 0.8kg per litre of paint for 57-70% Volume of Solids of Traffic Paint.

.8 The paint temperature shall be between 40°C and 70°C when applied to the pavement.

.9 Contractor shall remove all incorrect markings.

.10 Contractor shall protect pavement markings until dry.

3.4 ROUTING AND SEALING

.1 Perform routing and sealing of cracks.

.2 Routing and sealing to be performed as per the requirements of OPSS 341.

3.5 QUALITY CONTROL

.1 Perform QC testing as per Section 01 45 00 by Departmental Representative.

END

PART 1 - GENERAL

1.1 DELIVERY STORAGE AND HANDLING

.1 Deliver, store and handle water in accordance with Section 01 61 00 and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Water: in accordance with Departmental Representative's approval.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Apply water with equipment approved by Departmental Representative, when directed by Departmental Representative.

.2 Apply water with distributors equipped with the means to ensure uniform application.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 32 11 20 - Granular Base.

.2 Section 32 11 24 - Granular Sub-base.

.3 Section 31 22 13 – Rough Grading.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C233/C233M-18 Standard Test Method for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM D1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.2 Canadian Standards Association (CSA International)

.1 CSA A23.1:19/CSA A23.2:19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA B651-18 Accessible Design for the Built Environment.

.3 CSA A3001-18 Cementitious Materials Used in Concrete.

.3 Ontario Provincial Standard Specification (OPSS)

.1 OPSS.PROV 1010 November 2013, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS SDS.

.3 If materials have been tested by accredited testing laboratory testing laboratory approved by Departmental Representative within previous 2 months and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 QUALITY ASSURANCE

.1 Mock-ups
  .1 Provide a mock-up in accordance with requirements of Section 01 45 00 to Departmental Representative's approval.
.2 Mock-up shall demonstrate quality of work and shall be used for matching of pebble finish.
.3 Provide minimum of 3 mock-ups 500mmx500mm of decorative concrete paving demonstrating exposed pebble finish, colour and texture.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00.

.2 Joint filler, Curing Compound: in accordance with Section 03 30 00.

.3 Granular base: Granular A to OPSS/PROV 1010.

.4 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.

.5 Curing Agent: to ASTM C309, Type 1.

.6 Detectable warning plate shall be uncoated cast iron material with natural "rust" finish in accordance with the CSA B651.

.7 Concrete paving, ramps, walk and patio:
  .1 Cement: to CSA A3001, Type GU.
  .2 Compressive strength: 32 MPa at 28 days.
  .3 Exposure class: C-2 to CSA A23.1/A23.2.
  .4 Aggregate: 20 mm maximum size to CSA A23.1/A23.2.
  .5 Pebble finish: Provide 3mm to 6mm grey aggregate and matrix to match aggregate colour and providing a consistent appearance. Surface texture to be slip resistant.
  .6 Slump: 80 mm at time of deposit, +/-30 mm.
  .7 Air content: 5-8%.
  .8 Admixtures: air entraining to ASTM C233/C233M. Calcium chloride or compounds containing calcium chloride not permitted.
  .9 Water: potable.
  .10 Joint filler/separation board: preformed, asphalt saturated fibre to ASTM D1751.
  .11 Concrete sealer: approved for exterior use.

.8 Adhesives: type and application as recommended by manufacturer.

.9 Surface Retardant: CSA A23.1/A23.2.

PART 3 - EXECUTION

3.1 GRADE PREPARATION

.1 Do grade preparation work in accordance with Section 31 22 13.

3.2 GRANULAR BASE

.1 Obtain Departmental Representative's approval of subgrade before placing granular base.

.2 Place 150mm thick granular base to lines, widths, and depths as indicated.

.3 Compact granular base layers to at least 95% of Standard Proctor Maximum Dry Density.

3.3 CONCRETE

.1 Obtain Departmental Representative's approval of granular base prior to placing concrete.

.2 Do concrete work in accordance with Section 03 30 00.

.3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.

.4 Provide edging as indicated with 10 mm radius edging tool.

.5 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Departmental Representative can be demonstrated. Hand finish surfaces when directed by Departmental Representative.

3.4 TOLERANCES

.1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5 EXPANSION AND CONTRACTION JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.

.2 Install expansion joints at intervals of 6 m.

.3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.6 ISOLATION JOINTS

.1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.

.2 Seal isolation joints with sealant approved by Departmental Representative.

3.7 CURING

.1 Cure concrete by adding moisture continuously in accordance with CSA A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.

.2 Where burlap is used for moist curing, place two prewetted layers on concrete

surface and keep continuously wet during curing period.

.3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.8 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with material as directed by Departmental Representative.
.1 Compact and shape to required contours as indicated.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.10 INSTALLATION

.1 Concrete paving, ramps, walk and patio:
.1 Do concrete work to CSA A23.1/A23.2 and CSA B651.
.2 Install joint filler at expansion joints for full depth of concrete section. Apply sealant over expansion joints at building. Align joints in ramps, walks and curbs.
.3 Provide separation board between existing and new work.
.4 Screed concrete surface to slope minimum 6 mm in 3 m.
.5 Steel trowel curb surface.
.6 Finish panel edges with edging tool.
.7 Apply concrete sealer to manufacturer's instructions.

.2 Exposed pebble finish:
.1 Provide matrix mix of pebble aggregate.
.2 Spray surface retardant over surface and allow to harden.
.3 Expose pebble surface by washing and brushing away surface mortar to match depth of existing surface.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Agriculture and Agri-Food Canada
  .1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 Canadian Council of Ministers of the Environment (CCME)
  .1 PN 1340-2005, Guidelines for Compost Quality.

1.2 DEFINITIONS

.1 Compost:
  .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.

.3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth, and contain no toxic or growth inhibiting contaminates.

.4 Composed bio-solids to: CCME Guidelines for Compost Quality.

1.3 MEASUREMENT PROCEDURES

.1 Stripped sod and topsoil shall be disposed of off site.

.2 Items under this Section will include area graded and finished with fine grading of minimum depth 150mm topsoil and placement of sod include the maintenance of sod as defined in this Section.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.

.2 Store products indoors in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect from damage.

1.6 SCHEDULING OF SODDING WORKS

.1 Schedule of sodding works to coincide with preparation of soil surface and in accordance with schedule approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 TOPSOIL

.1 Topsoil for seeded areas and planting beds: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
- .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7% clay, and contain 2 to 10% organic matter by weight.
- .2 Contain no toxic elements or growth inhibiting material.
- .3 Finished surface free from:
  - .1 Debris and stones over 50 mm diameter.
  - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .4 Consistence: friable when moist.

2.2 SOD

.1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
- .1 Turf Grass Nursery Sod types:
  - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 50% Kentucky Bluegrass cultivars.
  - .2 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivars.
  - .3 Number One Named Cultivars: Nursery Sod grown from certified seed.
- .2 Turf Grass Nursery Sod quality:
  - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
  - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
  - .3 Mowing height limit: 35 to 65 mm.
  - .4 Soil portion of sod: 6 to 15 mm in thickness.

2.3 SOIL AMENDMENTS

.1 Fertilizer
- .1 Fertility: major soil nutrients present in the following amounts:
- .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
- .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
- .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
- .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
- .6 Ph value: 6.5 to 8.0.

.2 Sand: washed coarse silica sand, medium to course textured.

.3 Organic matter: compost in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting

the organic matter, stability and contaminant requirements.

.4 Use composts meeting Category B requirements for land fill reclamation and large scale industrial applications.

.5 Limestone:
.1 Ground agricultural limestone.

.6 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.4 SOURCE QUALITY CONTROL

.1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Obtain approval from Departmental Representative of sod at source.

.3 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

Part 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings and as instructed by Departmental Representative.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL AND SOD

.1 Begin topsoil stripping of areas after area has been cleared of brush and removed from site.

.2 When stripping topsoil, avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.3 Dispose of topsoil off site in accordance with Section 01 35 13.43.

3.3 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.
.2 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
.3 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
.4 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.5 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
.6 Remove debris which protrudes more than 75 mm above surface.
.7 Dispose of removed material off site in accordance with Section 01 35 13.43.
.8 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
.9 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.4 PLACING AND SPREADING OF TOPSOIL

.1 Place topsoil after Departmental Representative has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 For sodded areas keep topsoil 15 mm below finished grade.

.4 Manually spread topsoil soil around trees, shrubs and obstacles.

3.5 SOD PLACEMENT

.1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.

.2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.6 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.
.1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
.1 Leave surfaces smooth, uniform and firm against deep footprinting.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of installation until acceptance.

.2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 60 mm.

.3 Cut grass to 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas as directed by Departmental Representative.

.4 Repair and resod dead or bare spots to satisfaction of Departmental Representative.

3.8 ACCEPTANCE

.1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

.2 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
- .1 Sodded areas are properly established.
- .2 Sod is free of bare and dead spots.
- .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 m.
- .4 Sodded areas have been cut minimum 2 times prior to acceptance.

.3 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.9 SURPLUS MATERIAL

.1 Dispose of excess materials in accordance with Section 01 35 13.43.

3.10 WASTE MANAGEMENT AND DISPOSAL

.1 Proceed in accordance with Section 01 74 20.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 32 91 19.13 - Topsoil Placement and Grading.

1.2 SUBMITTALS

.1 Product Data.
  .1 Submit product data in accordance with Section 01 33 00.
  .2 Provide product data for:
    .1 Seed.
    .2 Mulch.
    .3 Tackifier.
    .4 Fertilizer.

1.3 SCHEDULING

.1 Schedule hydraulic seeding to coincide with preparation of top soil surface.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
  .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".

.2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
  .1 Type II mulch:
    .1 Made from newsprint, raw cotton fibre and straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.

.3 Tackifier: water dilutable, liquid dispersion.

.4 Water: free of impurities that would inhibit germination and growth.

.5 Fertilizer:
  .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
  .2 Commercial Grade (10-10-10)

PART 3 - EXECUTION

3.1 WORKMANSHIP

.1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.

.2 Clean-up immediately, any material sprayed where not intended, to satisfaction of Departmental Representative.

.3 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.

.4 Protect seeded areas from trespass until plants are established.

3.2 PREPARATION OF SURFACES

.1 Preparation of soil as per Section 32 91 19.13.

3.3 SLURRY APPLICATION

.1 Hydraulic seeding equipment:
- .1 Slurry tank.
- .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.

.2 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
- .1 Using correct nozzle for application.
- .2 Using hoses for surfaces difficult to reach and to control application.

.3 Blend application 500 mm into adjacent grass areas or sodded areas and previous applications to form uniform surfaces.

.4 Re-apply where application is not uniform.

.5 Remove slurry from items and areas not designated to be sprayed.

.6 Protect seeded areas from vehicle, equipment, and pedestrian trespass.

.7 Remove protection devices as directed by Departmental Representative.

3.4 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of seed application until acceptance by Departmental Representative.

.2 Grass Mixture:
- .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
- .2 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.

.3 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.5 ACCEPTANCE

.1 Seeded areas will be accepted by Departmental Representative provided that:
- .1 Plants are uniformly established. Seeded areas are free of rutted, eroded, bare or dead spots.

.2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END

PART 1 - GENERAL

1.01 SECTION INCLUDES

.1 Materials and installation for storm sewers, subdrains, and culverts.

1.02 RELATED SECTIONS

.1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.03 MEASUREMENT

.1 Storm Sewer pipe shall include supply, excavation, bedding placement, compaction of backfill to pavement sub-base.

.2 Items under this section related to the installation of perforated pipe shall include supply, excavation, bedding, placement, compaction of backfill to pavement sub-base.

1.04 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM D3350-14, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .2 ASTM D698-12e2, Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

.2 Canadian Standards Association (CSA International)
- .1 CSA B1800-18, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.8, B182.11 and B182.13).
  - .1 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.3 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.4 Transport Canada (TC)
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Ontario Provincial Standard Specification (OPSS)
- .1 OPSS.PROV 1010, November 2013, Ontario Provincial Standard Specification, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
- .2 OPSS.PROV 405, November 2017, Ontario Provincial Standard Construction Specification for Pipe Subdrains.

1.05 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.3 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.

.4 Certification to be marked on pipe.

.5 Submit to Departmental Representative 1 copy of manufacturer's installation instructions.

1.06 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.07 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

PART 2 - PRODUCTS

2.01 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to CSA B182.2.
.1 Standard Dimensional Ratio (SDR): 35.
.2 Locked-in Separate gasket and integral bell
.3 Nominal lengths: 6 m.

.2 The infiltration trench shall use a 150 mm diameter CL 300 perforated rigid high density corrugated polyethylene pipe with geotextile sock meeting Class 324430C and ASTM D3350, with connectors as the provisions of OPSS.PROV 405.

2.02 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material: to OPSS.PROV 1010 for:
.1 Granular A, maximum size 19.0 mm.
.2 Granular B, Type I, maximum size 26.5 mm.
.3 Clear stone, Type I, 19.0 m.(for infiltration trench)

2.03 BACKFILL MATERIAL

.1 As indicated in the Contract Drawings and in accordance with Section 31 23 33.01.

PART 3 - EXECUTION

3.01 PREPARATION

.1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

3.02 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01.

.2 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.

3.03 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 98% Standard Proctor Maximum Dry Density.

.6 Fill excavation below bottom of specified bedding adjacent to maintenance holes or catch basins with compacted bedding material.

3.04 INSTALLATION

.1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.

.2 Handle pipe using methods approved by Departmental Representative.
.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.
.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.

.7 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.

.8 Plug lifting holes with Departmental Representative approved prefabricated plugs, set in shrinkage compensating grout.

.9 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.10 Make watertight connections to maintenance holes and headwalls.
.1 Use shrinkage compensating grout when suitable gaskets are not available.

.11 Use prefabricated saddles or approved field connections for connecting pipes

to existing sewer pipes.
.1 Joint to be structurally sound and watertight.

3.05 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
.1 Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
.1 Do not dump material within 2 m of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 98% Standard Proctor Maximum Dry Density to ASTM D698.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 98% Standard Proctor Maximum Dry Density to ASTM D698.

.7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.06 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 200 mm compacted thickness to at least 90% Standard Proctor Maximum Dry Density to ASTM D698 up to grades as indicated.

.3 Place unshrinkable backfill in accordance with Section 31 23 33 01.

.4 In addition to other requirements, backfill must meet the environmental quality requirements in Subsection 1.9 of Section 01 35 13.43.

3.07 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Provide CCTV of all storm utility drains installed under this contract.

END

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

.1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.02 MEASUREMENT PROCEDURES

.1 CSP culvert pipe shall include supply, excavation, bedding, placement, compaction of backfill to pavement sub-base, supply and placement of rip rap end treatments.

.2 Storm subdrain and clearstone shall include subdrain installed complete with excavation, clearstone, geofabric, backfill to rough grade.

1.03 REFERENCES

.1 ASTM International
- .1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
- .2 ASTM D1248-16, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.

.2 CSA International
- .1 CAN/CSA-G401-14(R2019), Corrugated Steel Pipe Products.

.3 Ontario Provincial Standard Specification (OPSS)
- .1 OPSS.PROV 1010, November 2013, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
- .2 OPSS.PROV 1860, April 2012, Material Specification for Geotextiles.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.

1.05 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials in accordance with manufacturer's recommendations.
- .2 Store and protect pipes from damage.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.01 CORRUGATED STEEL PIPE

.1 Corrugated steel pipe: to CAN/CSA-G401.

2.02 SUBDRAIN PIPE

.1 100 mm PVC pipe as ATSM D1248 complete with Type II non-woven geotextiles to OPSS.PROV 1860.

.2 In addition to other requirements, backfill must meet the environmental quality requirements in Subsection 1.9 of Section 01 35 13.43.

2.03 GRANULAR BEDDING AND BACKFILL

.1 Granular bedding and backfill material to Section 31 05 16 and following requirements:

.1 Granular A to OPSS.PROV 1010.

.2 In addition to other requirements, backfill must meet the environmental quality requirements in Subsection 1.9 of Section 01 35 13.43.

PART 3 - EXECUTION

3.01 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01.

3.02 BEDDING

.1 Dewater excavation in accordance with Section 01 35 13.43, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 98% SPMDD.

.3 Place bedding in unfrozen condition.

3.03 BACKFILLING

.1 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.2 Compact each layer to 98% SPMDD to ASTM D698.

3.04 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.3 Waste Management: separate waste materials in accordance with Sections 01 74 19 and 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 – GENERAL

1.1 DESCRIPTION

.1 The requirements of this Section apply to all sections of Division 26 related to packaged or free-standing dual-axis tracking solar energy electrical power generation and storage systems.

1.2 RELATED SECTIONS

.1 Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL: General electrical installation requirements.

.2 Section 26 05 21, WIRES AND CABLES (0-1000 V): Requirements for current conductors.

.3 Section 26 05 28, GROUNDING - SECONDARY: Requirements for grounding.

.4 Section 26 05 31, 26 05 32, 26 05 34: Requirements for boxes, conduits, and raceways.

.5 Section 01 91 00, COMMISSIONING GENERAL REQUIREMENTS.

.6 Section 26 28 23, DISCONNECT SWITCHES: Requirements for disconnects.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):
.1 E772-11 Standard Terminology of Solar Energy Conversion
.2 E1038-10 Standard Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact with Propelled Ice Balls.

.2 Institute of Electrical and Electronics Engineers (IEEE):
.1 100-00, The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition
.2 519-2014, Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
.3 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.

.3 Canadian Standards Association (CSA International):
.1 CSA 22.1 ON-18, Ontario Electrical Safety Code, 27th Edition/2018, Section 64 and applicable bulletins.

.4 Underwriter’s Laboratories (UL):
.1 UL 6 Electrical Rigid Metal Conduit - Steel (Ed. 14)
.2 UL 94 Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances (Ed. 6)
.3 UL 797 Standard for Electrical Metallic Tubing - Steel (Ed. 7)
.4 UL 1242 Standard for Electrical Intermediate Metal Conduit - Steel (Ed. 4)
.5 UL 1703 Standard for Flat-Plate Photovoltaic Modules and Panels (Ed. 3)

.6 UL 1741/UL 1741SA Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, 2nd Edition
.7 UL 1973 ANSI/CAN/UL Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications.

.4 National Fire Protection Association (NFPA
.1 NFPA-70, Life Safety Code.

.5 Institute of Electrical and Electronics Engineers (IEEE)
.1 IEEE 519-2014 IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems
.2 IEEE 1547-2018 IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.

.5 International Electrotechnical Commission (IEC)
.1 IEC 60529 International Protection Marking
.2 IEC 61000-6-1,-2,-3,-4 Electromagnetic Compatibility
.3 IEC 61836 Solar Photovoltaic Energy Systems - Terms and Symbols
.4 IEC 62133 Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary lithium cells, and for batteries made from them, for use in portable applications

1.4 DEFINITIONS

.1 Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be defined in IEEE 100.

.2 Unless otherwise specified or indicated, solar energy conversion and solar photovoltaic energy system terms used in these specifications, and on the drawings, shall be defined in ASTM E772 and IEC 61836.

1.5 QUALITY ASSURANCE

.1. Solar Energy Electrical Power Generation System installer(s) shall demonstrate that they have successfully installed at least four projects that, in aggregate, equal or exceed the size of the proposed project. References shall be provided for each of these referenced projects.

.2 The solar energy electrical power generation and storage system shall:
.1 Be a packaged or free-standing system with a foundation capable of bearing and distributing system dead loads and withstanding environmental loads and forces such as frost heaving, sustained winds up to 25 m/s, wind gusts up to 40 m/s, and daily snow accumulation up to 50 cm;
.2 Have a small footprint not exceeding 1.5 m x 1.5 m, and an active or swept area not exceeding 5.2 m x 5.2 m x 5.2 m;
.3 Be a self-contained system with enclosure to house batteries, inverter, and charger;
.4 Have a dual-axis or comparable active tracking system capable of tracking the sun to optimize solar capture;

.3 The inverter system shall be off-grid capable. Inverters shall not be restricted to operate in grid-tied (anti-islanding) mode.

.4 Submit Solar Energy Electrical Power Generation System data package for the following items:
.1 Troubleshooting guide for solar photovoltaic systems.
.2 Solar photovoltaic module warranty.
.3 Operation instructions.
.4 Preventive maintenance and inspection data, including a schedule for system operators.

.5 Solar photovoltaic module warranty:
.1 Furnish ten year manufacturer’s warranty against defects in materials and workmanship.
.2 Furnish manufacturer’s warranty with respect to power output that continues for a total of 25 years: the first 10 years at 90% minimum rated power output and the balance of 20 years at 80% minimum rated power output.
.3 PV modules shall be UL approved.

.6 Inverter and Charger warranty:
.1 Furnish ten year manufacturer’s warranty against defects in materials and workmanship.
.2

.7 Charger warranty:
.1 Furnish ten year manufacturer’s warranty against defects in materials and workmanship.

1.6 SUBMITTALS

.1 Submit in accordance with Section 01 33 00, SUBMITTAL PROCEDURES and with requirements in the individual specification sections.

.2 Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

.3 If equipment submitted differs in arrangement from that shown on the submittals, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract and acceptable to the Departmental Representative.

.4 Prior to submitting shop drawings for approval, Contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications from the applicable other manufacturers, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

.5 Submittals and shop drawings for independent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

.6 Shop Drawings: Include photovoltaic module structural supports, interconnections and all other components, parts and pieces required to complete the functioning assembly. Where applicable, include pre-fabricated assemblies such as inverter skids or racking assemblies, and shop drawings for foundations or other support structures.

.7 Product Data: Include detailed information for components of the solar energy system.
.1 Wiring.
.2 Wiring Specialties.
.3 DC-AC Inverter.
.4 Solar Modules.
.5 Collector Supports.
.6 Instrumentation.
.7 Switch gear.
.8 DC and AC disconnects.
.9 Combiner boxes.
.10 Rack system.
.11 Monitoring systems, including appropriate interfacing with existing facility data collection systems.

.8 Certificates: Submit technical representative’s certification that the installation has been implemented as intended by the system designer and where applicable, recommended by the manufacturer.

.9 Manufacturer’s Instructions.

.10 Operation and Maintenance Solar Energy Systems Data Package:
.1 Safety precautions.
.2 Operator restart.
.3 Startup, shutdown, and post-shutdown procedures.
.4 Normal operations.
.5 Emergency operations.
.6 Environmental conditions.
.7 Preventive maintenance plan and schedule.
.8 Troubleshooting guides and diagnostic techniques.
.9 Wiring and control diagrams.
.10 Maintenance and repair procedures.
.11 Removal and replacement instructions.
.12 Spare parts and supply list.
.13 O&M submittal data.
.14 Parts identification.
.15 Testing equipment and special tool information.
.16 Warranty information.
.17 Testing and performance data.
.18 Installer information.

.11 Closeout Submittals:
.1 Posted operating instructions for solar photovoltaic energy system: provide for wiring identification codes and diagrams of solar photovoltaic systems, operating instructions, control matrix, and troubleshooting instructions.
.2 Solar photovoltaic system verification certificate per IEC 62446.

PART 2 – PRODUCTS

2.1 GENERAL

.1 Provide materials to fabricate a functioning Solar Energy Electrical Power Generation and Storage System in accordance with ASTM, IEEE, NEMA, NFPA, and UL, as specified in this section, and as shown on the drawings.

.2 Factory-prefabricated solar equipment package which includes photovoltaic modules, tracking system, batteries or other energy storage, inverters, chargers, controls and exterior enclosure and which meets the requirements of this section is strongly preferred.

.3 Factory-prefabricated solar equipment package: Contractor to supply and install conduit and wire between electrical room and solar package, supply and install conduit for wind sensor, construct concrete foundation, coordinate delivery of solar package to site by product distributor, offload, crane or hoist package to prepared foundation, uncrate, secure to foundation, and perform wiring connections. Trucking to site, system configuration, and commissioning to be performed by product distributor.

2.2 FOUNDATION

.1 Cast-in-place concrete foundation
- .1 Minimum horizontal dimensions: 2057 mm x 2057 mm
- .2 Minimum/maximum projection above grade: 76 mm

2.3 FIXING POINTS

.1 Maximum height of mounted array: 5.2 m

.2 Maximum active area of mounted array: 5.2 m

2.4 SOLAR TRACKER

.1 The Solar Energy Electrical Power Generation and Storage System shall include an active (motor and gear-drive)tip-tilt dual-axis tracker (TTDAT) with the following minimum features and capabilities:
- .1 Operate the attached array in sustained winds up to 25 m/s, wind gusts up to 40 m/s, and daily snow accumulation up to 50 cm
- .2 Include a remote pole-mounted wind sensor at 1.5-3 m height
- .3 Use wind sensor data to protect the solar array and supporting systems from damage from wind forces exceeding design parameters. This includes placing the array horizontal at winds exceeding 15 m/s, and stowing the array, where possible, at winds exceeding 18 m/s.
- .4 Have sufficient range of motion to maintain the solar PV array at a direct normal to the Sun above the horizon, throughout the year
- .5 Use Global Position System (GPS) to determine time of day, longitude, latitude, elevation, solar azimuth and elevation
- .6 Field-upgradeable software via remote (Internet) access, USB, or other portable non-proprietary technologies
- .7 In the event of GPS, position sensor or wind sensor failure, the unit shall automatically stow or place the array horizontal.

2.5 SOLAR ARRAY

.1 MECHANICAL MINIMUM PERFORMANCE CHARACTERISTICS

Cell Type	Mono-crystalline PERC.
Module Type	Glass/Backsheet.

.2 ELECTRICAL MINIMUM PERFORMANCE CHARACTERISTICS

	STC
Peak Power (Pmax)	2.5 kWp

.3 Hail Protection: Compliant with testing procedure per ASTM E-1038.

.4 Lightning Protection: Shall ground according to manufacturer instructions per UL 1703.

.5 Soiling: Shall include a daily self-cleaning function to clear accumulated debris and soiling

2.6 INVERTER

.1 Shall have stand-alone, utility-interactive, combined capabilities. Inverters shall not be restricted to operate in grid-tied (anti-islanding) mode.

.2 Shall be listed to UL 1741, UL 1741SA.

.3 Shall comply with IEEE 519 and IEEE 1547.

.4 Shall include independent maximum power point tracking (MPPT) features for each string input.

.5 Shall have 2 PV string inputs minimum.

.6 Shall include separate AC connections for:
- .1 Load
- .2 Grid (power import/export
- .3 Generator/Critical Loads

.7 Shall include Ethernet connection and Wifi connectivity capabilities to an onsite Internet access point (router or switch) within 45 metres, for remote monitoring, programming, and control.

.8 Shall include a TFT graphic display or equivalent user interface to enable field programming of onboard software and to display status of PV, inverter and charging system operating parameters.

.9 The inverter shall be rated, at a minimum:
- .1 9000 VA AC output
- .2 Peak 50A at 240V AC current
- .3 120/240 VAC split phase output
- .4 60 Hz nominal frequency
- .5 96.5% CEC peak efficiency

2.7 CHARGER

.1 The charge controller shall, at a minimum, be rated for:
- .1 500VDC maximum input

.2 150-425V MPPT voltage range
.3 18A working DC current
.4 Minimum 2 string inputs and MPPT trackers
.5 41-59V battery voltage range
.6 190A continuous battery charging output
.7 96% charging efficiency

.2 Shall include generator-start dry-contact to activate remote generator or grid transfer switch. Contact shall close upon system failure or upon battery bank State-of-Charge (SOC) dropping below a field-configured voltage.

.3 The charge controller shall include, at a minimum, the following protective devices:
.1 DC disconnect
.2 Arc-fault Circuit Interruption (AFCI)
.3 Ground fault protection

2.8 ENERGY STORAGE

.1 Batteries shall:
.1 Be of the lithium iron phosphate (LiFePO4) type.
.2 Be in sealed ABS plastic cases (UL 94-5VA flame retardant)
.3 Comply with the following safety and compliance standards:
.1 IEC62133; UL 1973
.2 REACH, RoHS and Battery Directive (2006/66/EC)
.3 IEC61000-6-1,-2, -3, -4
.4 UN Manual of Tests and Criteria Part III
.2 The energy storage system shall, at a minimum, be rated at:
.1 5.5 kWh total capacity
.2 52.8V nominal voltage
.3 105A maximum charge current
.4 4.5 kW maximum discharge power

2.9 GROUNDING

.1 Array frame shall be installed in accordance with NFPA 70 and CSA 22.1.

.2 Shall ground according to manufacturer instructions per UL 1703.

.3 DC Ground-Fault Protector:
.1 Shall be listed per UL 1703.
.2 Shall comply with requirements of CSA 22.1 to reduce fire hazards.
.3 Ungrounded DC solar photovoltaic arrays shall comply with the CSA.

2.10 PV ARRAY CIRCUIT COMBINER BOX

.1 Shall include internal overcurrent protection devices with dead front.

.2 Shall be contained in non-conductive NEMA Type 4X enclosure per NEMA 250.

.3 Up to 600 volts DC, paralleling system: Shall use fuses instead of

breakers.

.4 Shall be listed to UL 1741.

.5 Where applicable, combiner box shall be a disconnecting combiner box.

2.11 WIRING SPECIALTIES

.1 Direct Current Conductor:
.1 In Conduit: Shall use RHW-2, THWN-2, or XHHW-2 90°C [194°F], wet-rated conductors.

.2 Conduits and Raceways:
.1 Shall use solid steel conduit listed per UL 6, UL 1242, UL 797 (as appropriate). Weather tight EMT installations shall be allowed for DC wiring in weather protected areas.
.2 Shall use expansion joints on long conduit runs.
.3 Cannot be installed on modules.

.3 Weather impacted enclosures shall be rated to NEMA 3R or better.

.4 Cable Assemblies and Junction Boxes:
.1 Shall be UL-listed.
.2 Shall be rated IP65 or IP67 per IEC 60529.
.3 Shall be rated to 5VA flammability per UL 94.

.5 Prohibited Wiring Materials: Not UL-listed, or listed materials used in unapproved environments.

2.12 GROUND FAULT PROTECTION

.1 Photovoltaic inverters shall be equipped with D.C. ground fault protection to reduce fire hazards.

2.13 DISCONNECTING MEANS

.1 Means shall be provided to disconnect all equipment, including the power conditioning unit, from all non-grounded conductors from all sources. All sources must be clearly identified. Equipment with multiple sources must be clearly identified.

.2 All combiner boxes shall provide disconnection means for isolation and testing.

.3 All systems with floating grounds shall have a disconnecting means for the source circuit in the positive and negative conductors.

.4 All disconnects and combiners shall be secured from unauthorized/unqualified personnel by lock or location.

.5 All disconnects, combiners, pull/splice boxes, and enclosures shall be certified for its purpose.

.6 The grounded conductor may have a bolted or terminal disconnecting means

to allow for maintenance or troubleshooting by qualified personnel.

.7 A single disconnecting means shall be permitted for the combined A.C. output.

.8 Disconnecting means shall be provided to disconnect a fuse from all sources of supply if the fuse is energized from both directions and is accessible to other than qualified persons. Such a fuse in a photovoltaic source circuit shall be capable of being disconnected independently of fuses in other photovoltaic source circuits.

2.14 REQUIRED SAFETY SIGNS AND LABELS

.1 Required safety signs and labels shall be permanently attached by adhesive, or other mechanical means. Labels shall comply with CSA 22.1 Section 2-100 and other applicable local codes. See labels and marking page for more information.
.1 Any switch, fuses, or circuit breakers that can be energized in either direction shall be labeled as follows:

WARNING:
ELECTRICAL SHOCK HAZARD DO NOT TOUCH TERMINALS.
TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE
ENERGIZED IN THE OPEN POSITION.

.2 This photovoltaic system will be equipped with a D.C. disconnect which will be labeled as follows:
PHOTOVOLTAIC
DISCONNECT MEANS
D.C. DISCONNECT.

.3 This photovoltaic system will be equipped with an A.C. disconnect which will be labeled as follows:
PHOTOVOLTAIC
DISCONNECT MEANS
A.C. DISCONNECT.

.4 A marking specifying the photovoltaic power source rated as follows shall be provided at an accessible location at the disconnection means for the power source:
OPERATING CURRENT
OPERATING VOLTAGE
MAXIMUM SYSTEM VOLTAGE
SHORT CIRCUIT CURRENT.

2.15 MARKINGS

.1 All interactive system points of interconnection with other sources shall be marked at an accessible location at the disconnection means.

.2 A permanent plaque or directory shall be provided identifying the location of the service disconnection means and the photovoltaic system disconnection means, if not located at the same location.

.3 Photovoltaic modules shall be marked to identify lead polarity, device ratings, and specifications for voltage, currents, and power.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 FOUNDATION: Install the solar photovoltaic system in accordance with CSA 22.1, this section, and the printed instructions of the manufacturer. Prior to system start-up, ensure no copper wire remains exposed with the exception of grounding wire in certain circumstances per manufacturer instructions.

.2 WIRING INSTALLATION: Workers shall be made aware that photovoltaic modules will be live and generating electricity when there is any ambient light source and shall take appropriate precautions. Utilize on site measurements in conjunction with engineering designs to accurately cut wires and layout before making permanent connections. Locate wires out of the way of windows, doors, openings, and other hazards. Ensure wires are free of snags and sharp edges that have the potential to compromise the wire insulation. The system shall have direct current ground fault protection. Ensure breakers in combiner box are in the off position (or fuses removed) during combiner box wiring.

.3 INSTRUMENTATION: Install instruments as recommended by the control manufacturers. Locate control panels inside mechanical room.

.4 WIRING AND WIRING METHODS

.1 All wiring methods and installation practices shall conform to CSA 22.1, and other applicable local codes.

.1 Exposed PV solar panel wiring shall be rated for exposure to direct sunlight, wet environments, and be rated for a minimum of 90 degrees Celsius (RPVU). All exposed cables, such as module leads shall be secured with mechanical means rated for use in direct sunlight.

.2 All grounded conductors are marked green, green/yellow combination, or of bare copper.

.3 All field wiring that is not color coded shall be tagged at both ends with permanent wire markers to identify polarity and ground.

.4 PVC is not approved for installation in locations subjected to direct sunlight and shall not be employed in any such location.

.5 Long straight exposed conduit runs, 100 feet or more, shall have expansion fittings. Expansion fittings shall also be used when conduit spans an expansion joint.

.6 If used, all wire nuts are to be silicone filled, equivalent to ideal blue, and installed per manufacturers specifications by a qualified/certified person.

.7 Fuses and wires subject to transformer inrush current shall be sized accordingly.

.8 All D.C. materials shall be ULC/CSA listed for 600V DC or higher.

.9 The photovoltaic source circuits and photovoltaic output circuits of this proposed solar system shall not be contained in the same raceway cable tray, cable, outlet box, junction box, or similar fitting as feeders or branch circuits of other systems unless the conductors of the different systems are separated by a partition or are connected together.

.10 Connectors to be torqued per device listing or manufacturers specifications. All connections shall be torque marked with permanent marker.

.11 Splices and connectors shall be insulated with approved means. ULC/CSA certified electrical tape alone is not suitable as the only insulation means. Follow manufacturer's instructions for application of insulating product.

.12 All DC wiring shall be copper wire unless otherwise stated and rated for the appropriate voltage with a minimum voltage rating of 600V and temperature rating of 90 degrees Celsius. An equivalent substitute can be used upon engineering approval.

.13 Label combiner box wiring red for positive, black for negative and green or bare for ground.

.14 All AC wiring shall be copper wire, rated at 90 degrees C, 600V or approved equal.

.15 Conduits shall not enter the top of any outdoor equipment or enclosure.

.16 All conduit fittings shall be watertight when exposed to weather or when run indoors in sprinkled spaces.

.5 BONDING AND GROUNDING

.1 See Electrical diagram and Electrical details for additional bonding and grounding information.

.1 Only one connection point will be used for bonding DC circuits and AC circuits together for system grounding (referenced to the same point).

.2 Equipment bonding conductors and system bonding conductors shall be installed to minimize the number of turns and minimize the distance to ground.

.3 Non-current carrying metal parts shall be checked for proper bonding; noting that terminal lugs bolted on an enclosure's finished surface may be insulated because of paint/finish. Paint/finish at point of contact shall be properly removed.

.4 Modules shall be bonded with equipment bonding conductors to a location approved by the manufacturer with a means of bonding listed for this purpose. Where copper may contact aluminum racking or material, the conductor shall be spray painted with an appropriate product to stop corrosion of dis-similar metals.

.5 Module or panel bonding shall be arranged so that the removal of a module or panel from the PV source circuit does not interrupt the bonding connection with other PV source equipment.

.6 Grounding system components shall be listed for their purpose, including but not limited to ground rods, grounding lugs, grounding clamps, etc.

END OF SECTION

APPENDIX A

1. Project-Specific Designated Substances Survey - Search and Rescue Station, Port Weller, Ontario', Prepared by DST Consulting Engineers, dated Feb 21, 2018.

2. 'Designated Substances and Hazardous Building Materials Assessment - North Storage Shed and North Storage Bin', Prepared by Stantec Consulting Ltd, dated July 13, 2018.

3. 'Project Effects Determination for the Port Weller Search and Rescue Station Upgrade Project: Port Weller Coast Guard Station DFRP# 86422", Prepared by Arcadis, dated August 2018.

4. 'Update Phase I Environmental Site Assessment Report', Prepared by Englobe, dated March 29, 2018.

5. Soil and Groundwater Assessment in Support of Proposed Construction Project. Port Weller Search and Rescue Station, 4 Welland Canals Parkway, St. Catharines, ON. Prepared by Dillon Consulting. Dated February 4th, 2019.

6. Soil and Groundwater Assessment Recommendations, Port Weller Search and Rescue Station, Port Weller, Ontario. Prepared by Dillon Consulting. Dated February 5th, 2019

7. Search and Rescue Station (SAR) Revitalization. St. Catharines, ON. Final Geotechnical Investigation Report. Prepared by Englobe, dated October 16, 2019.

8. Hazardous Building Materials Assessment Fisheries and Oceans Canada, Port Weller, St.Catharines, Ontario. Prepared by Pinchin Environmental Ltd. Dated April 3, 2014.

9. CCME Phase I / II Environmental Site Assessment Search and Rescue Station Port Weller, Ontario. Prepared by Aqua Terre Solutions Inc. Dated February 11, 2009.

10. Search and Rescue Station (SAR) Revitalization. St. Catharines, Ontario – New Garage. Supplementary Geotechnical Investigation, Prepared by Englobe. 124-B0017786-0-01-100GE-R0002-01. Prepared by Englobe dated July 29, 2020.

PROJECT-SPECIFIC DESIGNATED SUBSTANCES SURVEY

DST Consulting Engineers Inc.
2150 Thurston Drive, Suite 203
Ottawa, Ontario, K1G 5T9
Tel.: (613) 748-1415 or 1-877-378-3745
Fax: (613) 748-1356
E-Mail: ottawa@dstgroup.com

Public Works and Government Services Canada
4900 Yonge Street
Toronto, Ontario, M2N 6A6

February 21, 2018

Attention: Meng Koh, Environmental Specialist

Subject: Project-Specific Designated Substances Survey
Search and Rescue Station, Port Weller, Ontario

DST File No.: GV-TA-027833
PSPC SOA No.: EQ447-141528-018

1.0 INTRODUCTION

DST Consulting Engineers Inc. (DST) was retained by Public Works and Government Services Canada (PWGSC) to prepare a project-specific Designated Substance Report (DSR) for the Office House, Galley House, adjoining building (breezeway), Rope Locker, Hoop House, and Storage Building located at the Search and Rescue Station in Port Weller, Ontario.

The Designated Substances Report is required under the *Ontario Occupational Health and Safety Act* in order to identify designated substances that may be present within the project areas. The *Canada Labour Code also* stipulates under *Part II, Section 124* that every employer shall ensure that the health and safety at work of every person employed by the employer is protected. By having a DSR conducted, the Project Manager will be able to inform his or her employees, contractors, and tenants of any designated substances that may be present and possibly disturbed throughout the duration of the project.

DST staff completed a visual evaluation of building materials for the presence of suspected designated substances and hazardous materials in the project work areas on December 13, 2017. DST returned to the site on January 4, 2018 to conduct bulk roofing material sampling.

2.0 SCOPE OF WORK

The survey implemented by DST included the 11 designated substances listed in Section 30 of the *Occupational Health and Safety Act, R.S.O. 1990, Chapter 0.1*. Designated Substances, as identified under the Ontario Occupational Health and Safety Act, are as follows:

- Acrylonitrile,
- Arsenic,
- Asbestos (both friable and non-friable),
- Benzene,
- Coke Oven Emissions,
- Ethylene Oxide,
- Isocyanates,
- Lead,

- Mercury,
- Silica, and
- Vinyl Chloride.

Other Hazardous Materials that are not classified as Designated Substances, but were included as part of the survey and considered pertinent due to applicable regulations, best practice guidelines and/or potential risks to human health and/or the environment, are:

- Polychlorinated Biphenyls (PCBs),
- Halocarbons,
- Mould, and
- Other hazardous materials, as deemed pertinent.

3.0 BACKGROUND INFORMATION REVIEW

Prior to the commencement of field work, DST project personnel reviewed past bulk sampling documentation, as pertinent to the project areas. As part of the project, DST reviewed the following reports:

- Hazardous Building Materials Assessment, Fisheries and Oceans Canada, Port Weller, Ontario. Prepared by Pinchin Environmental (Pinchin File: 92340). Dated April 3, 2014, and
- Project-Specific Designated Substances Survey – Galley House and Office House, Fisheries and Oceans Canada. Prepared by DST Consulting Engineers Inc. DST File No.: GV-TA-027833. Dated February 13, 2017.

DST referenced the identifiable sampling and analytical results of the above-noted documentation, where applicable. As such, materials already identified as asbestos-containing in previous documentation were not re-sampled by DST as part of this project specific survey. Non-asbestos sampling data from the above noted Pinchin report could not be relied upon as the laboratory method detection limit (MDL) for the bulk asbestos samples is listed as 1%, which does not meet the provincial requirement of 0.5%, as per Ontario Regulation 278/05. DST sampled all suspected asbestos containing materials previously collected by Pinchin to meet current regulatory requirements.

Furthermore, as part of the survey, the presence, quantity, and condition of asbestos-containing materials (ACMs) were confirmed by DST. DST's field program also included the sampling of any additional ACMs and lead (in paint) and the identification of other Designated Substances not previously noted or where uncertainty existed. Where applicable, a sufficient number of bulk asbestos samples were collected to satisfy the current bulk sampling requirements of O.Reg. 278/05, as amended.

4.0 METHODOLOGY

The purpose of the survey program was to identify designated substances and hazardous materials that may be disturbed during future work operations. The following buildings were included as part of the survey:

- Office House (1953 structure),
- Galley House (1931 structure),
- Adjoining building (breezeway with garage),
- Rope Locker Building,
- Hoop House Building, and
- Storage Building.

Materials suspected of containing designated substances were visually identified, based on the surveyor's knowledge of the historical composition of building products. Visual identification of materials suspected to contain asbestos or lead (in paint) was supported by the collection and analysis of a limited number of representative samples, where applicable. Materials suspected of containing designated substances other than asbestos or lead (in paint) were identified by appearance, age, and knowledge of historical applications.

In Ontario, a material is defined as an Asbestos-Containing Material (ACM) if the material has a minimum asbestos content of 0.5 per cent (%) by dry weight, as per *Ontario Regulation (O. Reg.) 278/05 Asbestos on Construction Projects and in Buildings and Repair Operations* enabled under the *Occupational Health and Safety Act (R.S.O. 1990, Chapter 0.1),* as amended. ACMs can be divided into two categories: friable and non-friable material. A friable ACM is a material that can be crumbled, powdered, or pulverized by hand pressure and can readily release fibres when disturbed. Common applications of friable ACMs are sprayed or trowelled surfacing materials (e.g. sprayed fireproofing and textured coatings) as well as mechanical and thermal insulation. Non-friable materials are materials that will generally release fibres only when cut or shaped. Common non-friable ACMs include vinyl floor products, caulking applications, asbestos textile products and asbestos cement products (transite). Some of these products may become friable with time or when disturbed.

Representative bulk samples of suspected ACMs were collected by DST during the site investigation. Samples were collected in order to meet the bulk sampling requirements stipulated in *O.Reg. 278/05, as amended*. Bulk samples were submitted to and analyzed by Paracel Laboratories Ltd. (Paracel). Paracel is an accredited laboratory through the Canadian Association for Laboratory Accreditation (CALA) and the National Voluntary Laboratory Accreditation Program (NVLAP). The bulk samples were analyzed using polarised light microscopy (PLM). This analytical method complies with the United States Environmental Protection Agency (U.S. EPA) Method 600/R-93/116 dated July, 1993, which is the regulatory approved protocol for bulk asbestos analysis in Ontario.

With regards to lead in paint, although the Ontario Ministry of Labour (MoL) has published a guideline for control of lead exposures on construction projects in Ontario, it does not include criteria for the classification of lead-paint. Instead, it uses presumed airborne lead concentrations

for specific tasks as criteria for classifying work. However, in regulations set by the United States (U.S.) Department of Housing and Urban Development, lead-based paint is classified as any paint application containing at least 1.0 milligrams of lead per square centimetre of surface area (1.0 mg/cm^2), or at least 0.5% lead content by weight [(5,000 parts per million (ppm)]. This criterion was widely, although not universally, used in Canada. In Canada, the Federal Canada Consumer Product Safety Act's *Surface Coating Materials Regulations SOR/2005-109* has lowered the allowable concentration of lead in paints for new consumer products to 0.009% lead content by weight (90 ppm). For the purposes of the survey and this report, paint applications having concentrations of lead above 90 ppm are considered to be lead-containing.

A bulk paint sample was collected by DST during the site investigation. The paint sample was submitted to and analyzed by Paracel using Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES).

Bulk asbestos and lead analytical results are included in Appendix A. Representative photographs are included in Appendix B.

5.0 FINDINGS

The following sections outline the complete findings of all accessible designated substances and hazardous building materials that were assessed within the buildings.

5.1. Asbestos

Table 1 below presents the findings of bulk asbestos samples collected from and applicable to the buildings, based on visual observations at the time of the site survey.

Table 1: Summary of Bulk Samples Analyzed for Asbestos Content by Polarized Light Microscopy (PLM) – DST (2017 & 2018)

Sample I.D.	Sample Location	Sample Description	Asbestos Content and Type
Office House			
27833-01A	**Office House, Basement, Water Treatment Room**	**Tar on Wall**	**1.79% Chrysotile Asbestos**
27833-01B			Not Analyzed – Stop Positive
27833-01C			Not Analyzed – Stop Positive
27833-03A	Office House, Basement	12" x 12" (30cm x 30cm) Vinyl floor tile with beige fleck and associated mastic	None Detected (tile)
			None Detected (mastic)
27833-03B			None Detected (tile)
			None Detected (mastic)
27833-03C			None Detected (tile)
			None Detected (mastic)
27833-04A	Office House, Basement Water Treatment Room	Paper strip around window	None Detected
27833-04B			None Detected
27833-04C			None Detected
27833-05A	Office House Basement, inside chimney	Brick Mortar	None Detected
27833-05B			None Detected
27833-05C			None Detected

Table 1: Summary of Bulk Samples Analyzed for Asbestos Content by Polarized Light Microscopy (PLM) – DST (2017 & 2018)			
Sample I.D.	**Sample Location**	**Sample Description**	**Asbestos Content and Type**
27833-06A	Office House, Ground Floor, Supernumerary Cabin 106	Vinyl Floor Tile and associated mastic (size and colour unknown, concealed under carpet)	None Detected (tile)
			None Detected (mastic)
27833-06B			None Detected (tile)
			None Detected (mastic)
27833-06C			None Detected (tile)
			None Detected (mastic)
27833-07A	Office House, Ground Floor, Supernumerary Cabin 106	Plaster (white and grey layers)	None Detected (white)
			None Detected (grey)
27833-07B	Office House, Ground Floor, Cabin 3		None Detected (white)
			None Detected (grey)
27833-07C	Office House, Ground Floor, Cabin 4		None Detected (white)
			None Detected (grey)
27833-07D	Office House, Ground Floor, Archway wall to Cabin		None Detected (white)
			None Detected (grey)
27833-07E	Office House, Stairwell to Basement		None Detected (white)
			None Detected (grey)
27833-08A	Office House, Ground Floor, Washroom	Vinyl Floor Tile and Associated Mastic (concealed beneath ceramic tile)	None Detected (tile)
			None Detected (mastic)
27833-08B			None Detected (tile)
			None Detected (mastic)
27833-08C			None Detected (tile)
			None Detected (mastic)
27833-09A	Office House, Ground Floor Washroom	Drywall Joint Compound	None Detected
27833-09B			None Detected
27833-09C			None Detected
27833-10A	Office House, Cabin 4	Flooring Paper under hardwood flooring	None Detected
27833-10B			None Detected
27833-10C			None Detected
27833-11A	Office House, Ground Floor, Main Office Area	Textured Ceiling Plaster	None Detected
27833-11B			None Detected
27833-11C			None Detected
27833-12A	Office House, Interior/Perimeter wall	Tar paper backing, wall insulation	None Detected
27833-12B			None Detected
27833-12C			None Detected
Garage			
27833-14A	Garage, Exterior Wall	Fibreboard	None Detected
27833-14B			None Detected
27833-14C			None Detected
27833-15A	Garage, Ceiling	Drywall Joint Compound	None Detected
27833-15B			None Detected
27833-15C			None Detected
Breezeway			
27833-02A	Breezeway, Fitness Room	Drywall Joint Compound	None Detected
27833-02B			None Detected
27833-16A			None Detected
27833-16B			None Detected
27833-16C			None Detected

Table 1: Summary of Bulk Samples Analyzed for Asbestos Content by Polarized Light Microscopy (PLM) – DST (2017 & 2018)			
Sample I.D.	**Sample Location**	**Sample Description**	**Asbestos Content and Type**
27833-17A	Washroom 2, (interior wall, associated with exterior wall of Galley House)	Fibreboard	None Detected
27833-17B			None Detected
27833-17C			None Detected
27833-18A	Generator Room	Drywall Joint Compound	None Detected
27833-18B			None Detected
27833-18C			None Detected
27833-19A	Generator Room	White woven wrap insulation on generator cable	None Detected
27833-19B			None Detected
27833-19C			None Detected
Galley House			
27833-20A	Galley House, Living Room	Drywall Joint Compound	None Detected
27833-20B	Galley House, Cabin 2		None Detected
27833-20C	Galley House, Cabin 1		None Detected
27833-21A	Galley House, Living Room, Above Doorway	Fibreboard	None Detected
27833-21B			None Detected
27833-21C			None Detected
27833-22A	**Galley House, Living Room Floor**	**Black Adhesive under plywood floor, middle layer**	**1% Chrysotile**
27833-22B			Not Analyzed – Stop Positive
27833-22C			Not Analyzed – Stop Positive
27833-23A	Galley House, Furnace Room	Vinyl Floor Tile and associated mastic (assumed concealed under carpet and ceramic throughout)	None Detected (tile)
			None Detected (mastic)
27833-23B			None Detected (tile)
			None Detected (mastic)
27833-23C			None Detected (tile)
			None Detected (mastic)
Exterior			
27833-24A	Office House, Exterior Wall	Tar Paper, Beneath Pebble Dash Stucco	None Detected
27833-24B			None Detected
27833-24C			None Detected
27833-25A	Office House, Exterior Wall	Pebble Dash Stucco	None Detected
27833-25B			None Detected
27833-25C			None Detected
27833-26A	Office House, exterior wall adjacent metal flashing	Caulking	None Detected
27833-26B			None Detected
27833-26C			None Detected
27833-27A	Office House, Exterior Window	Caulking	None Detected
27833-27B			None Detected
27833-27C			None Detected
27833-28A	Breezeway Building, adjacent pebble dash stucco under metal siding	Caulking	None Detected
27833-28B			None Detected
27833-28C			None Detected
Storage Building			
27833-29A	Storage Building	Vinyl Sheet Flooring	None Detected
27833-29B			None Detected
27833-29C			None Detected

Table 1: Summary of Bulk Samples Analyzed for Asbestos Content by Polarized Light Microscopy (PLM) – DST (2017 & 2018)			
Sample I.D.	**Sample Location**	**Sample Description**	**Asbestos Content and Type**
27833-30A	Storage Building	Tar Paper backing on fibreglass wall insulation	None Detected
27833-30B			None Detected
27833-30C			None Detected
Roofing Materials			
27833-31A	Storage Building	Roofing Tar Paper	None Detected
27833-31B			None Detected
27833-31C			None Detected
27833-32A	Storage Building	Roof Shingle	None Detected
27833-32B			None Detected
27833-32C			None Detected
27833-13A	Office House	Roof Shingle and Paper Membrane	None Detected
27833-13B			None Detected
27833-13C			None Detected
27833-33A	Roof, Overhang adjacent garage	Tar Paper	None Detected
		Paper	None Detected
		Plastic	None Detected
27833-33B		Tar Paper	None Detected
		Paper	None Detected
		Plastic	None Detected
27833-33C		Tar Paper	None Detected
		Paper	None Detected
		Plastic	None Detected
27833-34A	Roof, Breezeway	Tar	None Detected
		Tar Paper	None Detected
		Paper	None Detected
		Plastic	None Detected
		Foam	None Detected
27833-34B	Roof, Galley House (1931 House)	Tar	< 0.5% Chrysotile
		Tar Paper	None Detected
		Paper	None Detected
		Plastic	None Detected
		Foam	None Detected
27833-34C	Roof, Galley House (1931 House)	Tar	None Detected
		Tar Paper	None Detected
		Paper	None Detected
		Plastic	None Detected
		Foam	None Detected

Note: **Bold** items represent materials that contain regulated concentrations of asbestos (greater than 0.5%) as per O.Reg 278/05, as amended.

5.1.1. Asbestos-Containing Materials

Bulk sampling and subsequent laboratory analysis performed by DST or others has determined that the following materials contain regulated amounts of asbestos:

Office House

- Non-friable black tar, applied to the wooden frame within the Basement Water Treatment Room of the Office House contains 1.79% Chrysotile Asbestos (Sample 27833-01A). Approximately 5 linear metres of this material was observed in the Water Treatment Room (Boiler Room) at the time of inspection.

Galley House

- Non-friable mastic, applied to the plywood subfloor in the Galley House living room contains 1% Chrysotile Asbestos (Sample 27833-23A). The extent of this material could not be ascertained as it was concealed beneath plywood sheeting. As such, this material should be assumed present throughout all of the ground floor rooms/areas of the Galley House, unless additional destructive investigation confirms otherwise.

Exterior

- Non-friable caulking, applied to the exterior windows frames throughout the exterior contains 2% Chrysotile Asbestos (Sample 0004A, Pinchin File No. 92340). Approximately 175 linear metres of caulking is present.
- Non-friable caulking, applied to basement windows throughout the exterior of the buildings contains 5% Chrysotile Asbestos (Sample 0006A, Pinchin File No. 92340). Approximately 5 linear metres of this material was observed at the time of site visit.

5.1.2. Non-Asbestos-Containing Materials

Bulk sampling and subsequent laboratory analysis performed by DST or others have determined that the following materials do not contain regulated amounts of asbestos:

Office House

- 12”x12” (30cm x 30cm) beige vinyl floor tile and mastic in the basement of the Office House (Samples 27833-03A-C),
- Paper strip material around former window opening, Basement, Water Treatment Room (Samples 27833-04A-C),
- Brick Mortar, chimney (Samples 27833-05A-C),
- Vinyl floor tile and associated mastic (size and colour unknown, concealed beneath carpet), Ground Floor, Supernumerary Cabin 106 (Samples 27833-06A-C),
- Plaster throughout the Office House (Samples 27833-07A-E),
- Vinyl Floor Tile and associated mastic (size and colour unknown, concealed beneath ceramic), Ground Floor, Washroom (Samples 27833-08A-C),
- Drywall joint compound associated with drywall materials throughout Office House (Samples 27833-09A-C),
- Flooring paper under hardwood flooring materials throughout the ground floor (Samples 27833-10A-C),

- Textured ceiling plaster, Ground Floor, Main Office (Samples 27833-11A-C),
- Tar paper backing of fiberglass wall insulation (Samples 27833-12A-C), and
- Shingle and membrane roofing materials (Samples 27833-13A-C),

Garage

- Fiberboard material in perimeter, exterior walls (Samples 27833-14A-C),
- Drywall joint compound associated with drywall materials (Samples 27833-15A-C), and
- Roof, Overhang adjacent garage (Samples 27833-33A-C).

Breezeway

- Drywall joint compound associated with drywall materials (Samples 27833-02A-B, 27833-16A-C),
- Fibreboard, washroom opening, leading to exterior of Galley House (Samples 27833-17A-C),
- Drywall joint compound associated with drywall materials, Generator Room (Samples 27833-18A-C),
- White woven wrap on generator cable (Samples 27833-19A-C), and
- Roofing materials layers (Samples 27833-34A-C).

Galley House

- Drywall joint compound associated with drywall materials (Samples 27833-20A-C),
- Fibreboard above living room doorway (Samples 27833-21A-C),
- Roofing materials layers (Samples 27833-34A-C).

Exterior

- Tar paper beneath exterior pebble dash stucco (Samples 27833-24A-C),
- Pebble Dash Stucco on the exterior and under metal siding (Samples 27833-25A-C),
- Other exterior caulking applications were samples and confirmed to not contain asbestos (Samples 27833-26A-C. 27833-27A-C, 27833-28A-C),

Storage Building

- Vinyl sheet flooring (Samples 27833-29A-C),
- Tar paper backing associated with fiberglass wall insulation (Samples 27833-30A-C),
- Roofing shingles and tar paper membrane (Samples 27833-31A-C and 27833-32A-C).

Rope Locker Building and Hoop House Building

No suspected asbestos-containing materials were observed associated with these buildings.

It should be noted that DST did perform intrusive, destructive investigations into the ceiling of the Breezeway as well as representative perimeter walls, including siding and flooring of all applicable structures in this scope of work.

5.2. Benzene

Benzene is assumed to be a constituent ingredient in fuels associated with the following (fuel storage tank information as per Taylor Hazell Architects, 2016[1]):

- 11,000 L diesel tank,
- 1,900 L Gasoline tank,
- 1,100 L Heating oil tank #1,
- 1,100 L Heating oil tank #2,
- 620 L Diesel Tank,
- 500 L Waste Oil Tank, and
- Fuel and fuel containers associated with vehicles and equipment.

5.3. Lead

Table 2 below presents the findings of bulk lead (in paint) samples collected from a previous survey (Pinchin, 2014) and by DST (2017).

Table 2: Summary of Bulk Paint Samples Analyzed for Lead Content Analysis by Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES)

Sample I.D.	Sampled by, Year	Sample Location	Sample Description	Lead Content (ppm or µg/g)
L001	**Pinchin, 2014**	**Cabin #2, Galley House**	**White Wall Paint**	**5,200**
L002		**Breaker Closet, Galley House**	**Beige Wall Paint**	**150,000**
L003		**Connecting Garage**	**Grey Floor Paint**	**4,800**
L004		**Basement Office House**	**White Wall Paint**	**950**
L005		First Floor Corridor, Office House	Blue Wall Paint	<70
L006		**Exterior, Galley House**	**Blue-Grey Wall Paint**	**1,400**
L007		**Exterior, Galley House**	**Grey Wall Paint**	**160,000**
L008		**Exterior, Galley House**	**White Door Frame Paint**	**Presumed Lead**
L009	**Pinchin, 2014**	**Exterior, Galley House**	**Black Window Paint**	**37,000**
27833- L010	**DST, 2017**	**Basement, Office House**	**Grey Floor Paint**	**3,840**

Note: **Bold** items exceed the 90 ppm limit for lead, as per *Canada Consumer Product Safety Act's Surface Coating Materials Regulations SOR/2005-109* (as amended).

[1] Port Weller Search and Rescue Station, Building Condition Report, Investigation and Testing Scope and As Built Drawings. August, 2016.

Based on the analytical results outlined in Table 2, all paints in bold paints contain concentrations of lead greater than the Federal Canada Consumer Product Safety Act's limit of 90 ppm. All paints were generally in good condition at the time of the survey.

No other lead paint samples were collected by DST for lead content analysis, as other paints and surface coatings encountered were in good condition and sampling without matrix interference (i.e. removing the paint without the substrate material) would have proved difficult. All other paints and surface coatings shall be assumed to contain detectable concentrations of lead, unless specific bulk sampling and laboratory analysis confirms otherwise.

Lead is also assumed to be present in the following materials that were noted during the site visit:

- Solder on the joints of copper piping,
- Cast iron drain pipe joint caulking,
- Ceramic tile glazing, and
- Emergency light batteries.

5.4. Mercury

Mercury is assumed to be present in the following:

- Fluorescent light fixtures containing fluorescent light tubes were observed within the buildings. Fluorescent light tubes contain mercury in a vapour form and in the phosphor coating on the lamp tube.

5.5. Silica

Based on the historical composition of building materials, silica is assumed to be present in the following:

- Concrete and cement materials,
- Drywall and associated materials,
- Vinyl flooring materials,
- Stucco,
- Roofing materials,
- Ceramic tiles, mortar, grout, and
- Plaster.

5.6. Hazardous Materials

5.6.1. Halocarbons

Refrigerators within the Office House and Galley House are suspected to contain halocarbons.

5.6.2. Mould

Approximately 2 square metres of suspect mould growth was observed in the Basement, Water Treatment Room, Office House, on the concrete block walls behind the equipment.

5.6.3. Other Hazardous Materials

The following additional hazardous material was identified by DST:

- Various containers of chemicals, paints, degreasers and cleaning products stored in the various buildings.

5.7. Other Designated Substances and Hazardous Materials

The following Designated Substances and Hazardous Materials were neither observed, nor suspected of being present, in forms or quantities expected to have an impact on future work operations based on the understood project scope of work, associated with the Buildings of the Search and Rescue Station in Port Weller, Ontario:

- Acrylonitrile,
- Arsenic,
- Coke Oven Emissions,
- Ethylene Oxide,
- Isocyanates,
- PCBs, and
- Vinyl Chloride.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the site investigation, sampling and analysis, the following Designated Substances and Hazardous Materials are present in forms and quantities expected to have an impact on future work operations based on the understood project scope of work, associated with the Buildings of the Search and Rescue Station in Port Weller, Ontario:

- Asbestos,
- Benzene,
- Lead,
- Mercury,
- Silica, and
- Halocarbons.

DST's recommendations for each material, which are based upon both regulatory compliance and best practice guidelines, are included in the following sections below.

6.1. Asbestos

The disturbance of ACMs on construction and demolition projects is governed by the *Canada Occupational Health and Safety Regulations, PSPC Asbestos Management Directive,* and in the

province of Ontario is governed by *O.Reg. 278/05*, as amended. These regulations classify all asbestos disturbances as Low Risk (Type 1), Moderate Risk (Type 2), or High Risk (Type 3), each of which has defined precautionary measures. All asbestos materials are subject to specific handling and disposal precautions, and must be removed prior to demolition. The Ontario Ministry of Labour (MoL) must be notified of any project involving removal of more than a minor amount (e.g. typically 1 square metre) of friable asbestos material. In the event of conflict between regulations, the more stringent procedures apply.

Low-Risk work procedures can be used for the removal of non-friable ACMs (e.g. Window Caulking, Tar, and Mastic), provided that the material can be wetted and removed using only non-powered hand tools. If the material cannot be wetted during the operation, Moderate-Risk work procedures must be used (provided also that only non-powered hand tools are used). If these conditions cannot be met more stringent work procedures will be required.

The breaking, cutting, drilling, abrading, grinding, sanding, or vibrating of non-friable asbestos-containing materials, if the work is done by means of a power tool that is attached to a dust-collecting device equipped with HEPA filters, can be performed using Moderate-Risk asbestos work procedures. The breaking, cutting, drilling, abrading, grinding, sanding, or vibrating of non-friable asbestos-containing materials, if the work is done by means of a power tool that is not attached to a dust-collecting device equipped with HEPA filters, requires High-Risk asbestos work procedures.

The transport and disposal of asbestos waste is governed by *O. Reg. 347/90 – General – Waste Management*, as amended. This regulation requires that asbestos waste be sealed in appropriately labelled, double containers resistant to puncture and tears. The waste must be disposed at a licensed waste disposal site.

The time weight average exposure limit (TWAEL) for airborne asbestos is prescribed *by O.Reg. 490/09 Designated Substances*, as amended and the *Canada Labour Code, Occupational Health and Safety Regulations*. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne asbestos levels that exceed this TWAEL.

The following recommendations apply to ACMs and suspected ACMs:

- Appropriate work procedures and precautionary measures must be used, as outlined in *O.Reg. 278/05, PSPC Asbestos Management Directive, and the Canada Labour Code, Canada Occupational Health and Safety Regulations*, as amended, when performing work that may disturb ACMs or suspected ACMs, including prior to building demolition.
- Disturbance and/or removal of ACMs must be appropriately recorded as part of the building's Asbestos Management Plan.
- Before undertaking any work activity that involves asbestos-containing materials, an Asbestos Exposure Control Plan shall be developed, in accordance with the requirements of the *Canada Labour Code, Occupational Health and Safety Regulations*, which includes

classification of asbestos specific work activities, onsite labelling of ACMs, and education/training of applicable federal employee's specific to ACMs.

- If ACMs or suspected ACMs become damaged and worker exposure to the material is likely to occur, the damaged material must be repaired or removed following work procedures outlined in *O. Reg. 278/05, PSPC Asbestos Management Directive, and Canada Labour Code, Occupational Health and Safety Regulations, as amended.*
- Disposal of asbestos waste is controlled by the Ontario Environmental Protection Act, *Regulation 347/90, General – Waste Management,* as amended. This regulation requires that asbestos waste be sealed in double containers resistant to puncture and tears, and appropriately labelled. The waste must be disposed at a licensed waste disposal site. Proper notification must be issued to the site representative prior to transportation of waste. The transport of the waste to the disposal site is controlled by the federal *Transportation of Dangerous Goods Act, 1992* (TDGA).

Future abatement of ACMs must consider the requirements of the *PSPC Asbestos Management Directive and* the *Canada Labour Code, Occupational Health and Safety Regulations*, as amended. These requirements include air sampling associated with Moderate Risk (Type 2) and High-Risk (Type 3) abatement work operations.

DST made every attempt to evaluate the project areas to identify and quantify hazardous materials present. In spite of these efforts, some ACMs may be concealed and not observed at the time of the survey. As such, should any previously unidentified suspect ACMs be encountered as part of future work, these materials are to be treated as ACMs and handled accordingly, unless sampling proves otherwise. Materials that have not been analyzed, but are visibly similar to other materials identified as asbestos-containing, must be considered asbestos-containing unless proven otherwise by laboratory analysis.

6.2. Benzene

There are no regulations that specifically govern the disturbance of benzene on construction projects. Industrial processes involving benzene are regulated under "Designated Substances" O.Reg. 490/09, of the Occupational Health and Safety Act. The transport of the waste to the disposal site is controlled by the federal Transportation of Dangerous Goods Act (TDGA), as amended.

The time weighted average exposure limit (TWAEL) for benzene is prescribed by Ontario Regulation 490/09 Designated Substances, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to benzene levels that exceed this TWAEL.

6.3. Lead

The Occupational Health and Safety Branch (OHS) of the Ontario MoL have published *Guideline: Lead on Construction Projects*. This document classifies all lead disturbances as Type 1, Type 2a, Type 2b, Type 3a or Type 3b work, and assigns different levels of respiratory protection and

work procedures for each classification. Disturbance of lead-containing coatings shall follow the procedures of this guideline document.

Paints containing elevated concentrations of lead can pose a health risk to humans if ingested or inhaled. Such lead paints are also a risk to the environment with the potential to contaminate soil and groundwater. Paints with elevated lead content can also pose a health risk to workers while completing renovations within the building.

Although the Canada Consumer Product Safety Act's *Surface Coating Materials Regulations SOR/2005-109*, as amended, has set a limit of 90 parts per million (ppm) for surface coating materials, there may be a potential for exposure to high levels of airborne lead depending on the work activities performed that disturb the lead-containing materials, even at low lead content concentrations. Conducting a risk assessment to assess the potential for exposure to lead should be performed to determine the need to follow work procedures such as those in the MoL guideline referenced above.

In the event of conflict between lead precautionary measures and other precautionary measures (e.g. asbestos, silica), the more stringent procedures shall apply.

The time weighted average exposure limit (TWAEL) for airborne lead is prescribed by *O.Reg. 490/09 Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne lead levels that exceed this TWAEL.

The disposal of construction waste containing lead is governed by *O.Reg. 347/90* - General – Waste Management, as amended. The transport of the waste to the disposal site is controlled by the federal TDGA. Materials with elevated concentrations of lead should be subject to toxicity characteristic leaching procedure (TCLP) testing to determine toxicity with respect to lead prior to disposal, in accordance with *O.Reg. 347/90, as amended*.

Prior to or during renovation work, the following additional procedures should be performed with respect to other anticipated lead-containing materials:

- Copper piping and cast iron drain pipe joint caulking can be cut a small distance (e.g. 50 mm) from the joints to avoid direct disturbance of the lead material,
- Ceramic tiles can be removed using Type 1 lead precautionary measures, provided select hand tools are used or a power tool equipped with a HEPA vacuum attachment. If these conditions cannot be met, then more stringent procedures are required, and
- Emergency light batteries and other batteries should be removed when decommissioned and disposed of as lead-containing waste.

6.4. Mercury

There are no regulations that specifically govern the disturbance of mercury on construction projects. However, the Occupational Health and Safety Division of the Ontario MoL has published

The Safe Handling of Mercury: A Guide for the Construction Industry. This document provides advice on how to reduce the risk of mercury exposure, and outlines clean-up methods for spills. In the absence of specific legislation for mercury on construction projects, this guideline would serve as a reasonable, peer reviewed standard for work procedures.

When removal of the fluorescent light tubes is required, the tubes should be removed intact from the fixtures and appropriately stored. This prevents worker exposure to mercury vapour, particularly if the tubes were energized shortly before removal.

The TWAEL for mercury is prescribed by *O.Reg. 490/09 Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne mercury levels that exceed this TWAEL.

Liquid mercury is classified as a hazardous waste under *O.Reg. 347/90, as amended*. The transport of the waste to a disposal site is controlled by *O.Reg. 347/90* and by the federal *TDGA.* It is now common practice to recycle fluorescent light tubes, and other items containing mercury, recovering the component materials, and avoiding the generation of hazardous waste.

6.5. Silica

The Occupational Health and Safety Branch of the Ontario MoL have published *Guideline: Silica on Construction Projects*. This document classifies all silica disturbances as Type 1, Type 2 or Type 3 work, and assigns different levels of respiratory protection and work procedures for each classification. This guideline should be followed during disturbance of silica-containing materials. It is preferable to use more stringent dust suppression techniques and engineering controls as opposed to relying on respiratory protection to control worker exposure. Respiratory protection should only be relied on as a last resort when dust suppression techniques and engineering controls fail to control worker exposure.

The TWAEL for airborne silica is prescribed by *Ontario Regulation 490/09 Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne silica levels that exceed this exposure limit.

6.6. Halocarbons

The handling, transport and disposal of halocarbons is governed by the following:

- Federal Halocarbon Regulations (FHR), 2003,
- Ozone-depleting Substances and Halocarbon Alternatives Regulations, 2016,
- Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems, 2015, and
- Transport of Dangerous Goods Act.

When suspected halocarbon-containing equipment is taken out of service, the halocarbons must be captured and reclaimed by a certified service technician using methods and containers that are designed to contain the halocarbon. The service technician must provide written acknowledgement of the requirements of the FHR. Appropriate records of service technician

certification and records of equipment decommissioning must be provided and maintained in accordance with requirements of the FHR.

6.7. Mould

Removal of mould impacted concrete is not required prior to building demolition. Should disturbance of mould impacted materials be required, currently there are no regulations pertaining to mould on construction projects. Most jurisdictions have issued alerts or bulletins concerning the hazard of mould in indoor environments. The Canadian Construction Association (CCA) published the following document as a response to concerns in the construction industry: CCA 82-2004, "Mould Guidelines for the Canadian Construction Industry", 2004. The Guideline recommends Level I, II and III mould abatement procedures for small (<1 m^2), medium (1 m^2 to 10 m^2) and large scale (>10 m^2) mould abatement operations that are to be determined by professionals based on the extent and density of mould on site.

6.8. Other Hazardous Materials/Substances

The handling and use of maintenance chemicals and products should be undertaken by those with proper training (e.g. Workplace Hazardous Materials Information System, etc.) and adhere to any applicable guidelines and/or regulations. Prior to renovation or demolition operations, they should be removed using appropriate personal protective equipment and disposed of appropriately.

The transport and disposal of chemical waste is governed by O*. Reg. 347/90 – General – Waste Management*, as amended.

7.0 CLOSURE

A Limitations of Report section, which forms an integral part of this report, is attached.

We trust that the information contained herein meets your needs. Should you have any questions or comments, please do not hesitate to contact us.

DST CONSULTING ENGINEERS INC.

for
Justin Seedial B.Sc.,
Environmental Scientist
jseedial@dstgroup.com

Brendan Harrigan, P.Eng.
Director of Government Client Group
bharrigan@dstgroup.com

LIMITATIONS OF REPORT

This report is intended for client use only. Any use of this document by a third party, or any reliance on or decisions made based on the findings described in this report, are the sole responsibility of such third parties, and DST Consulting Engineers Inc. accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions conducted based on this report. No other warranties are implied or expressed.

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the client. The sampling program included asbestos bulk sampling, and lead (in paint) in select representative areas for laboratory analysis. There is a practical limitation on the number of samples that can be collected in a building. This requires the investigator to extrapolate observations and analytical results between sample locations. The uncertainty, and inherent risk, associated with this necessity increases with the distance between sampling locations. Note, however, that no scope of work, no matter how exhaustive, can guarantee to identify all contaminants. This report therefore cannot warranty that all building conditions are represented by those identified at specific locations.

Note also that standards, guidelines and practices related to DST's scope of work may change with time. Those which were applied at the time of this program may be obsolete or unacceptable at a later date.

Any comments given in this report on potential remediation problems and possible methods are intended only for the guidance of the designer. The scope of work may not be sufficient to determine all of the factors that may affect construction, clean-up methods and/or costs. Contractors bidding on this project or undertaking clean-ups should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the client.

APPENDIX A

Laboratory Certificates of Analysis – Bulk Asbestos and Lead

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

15 - 6800 Kitimat Rd
Mississauga, ON, L5N 5M1
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

DST Consulting Engineers Inc. (Toronto)

2680 Matheson Boulevard East, Suite 102
Mississauga, ON L4W 0A5
Attn: Pedram Nejatbakhsh

Client PO:
Project: GV TA 27833
Custody:

Report Date: 14-Dec-2016
Order Date: 12-Dec-2016

Order #: 1651034

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1651034-01	27833-1A
1651034-02	27833-1B
1651034-03	27833-1C
1651034-04	27833-2A
1651034-05	27833-2B

Approved By:

Emma Diaz

Senior Analyst

PARACEL LABORATORIES LTD.

Order #: 1651034

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 14-Dec-2016

Order Date: 12-Dec-2016

Project Description: GV TA 27833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1651034-01	08-Dec-16	sample homogenized	Black	Tar	**Yes**	Client ID: 27833-1A [AS-PRE]	
						Chrysotile	1.79
						Non-Fibers	98.21
1651034-02	08-Dec-16					Client ID: 27833-1B	
						not analyzed	
1651034-03	08-Dec-16					Client ID: 27833-1C	
						not analyzed	
1651034-04	08-Dec-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833-2A	
						Non-Fibers	100
1651034-05	08-Dec-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833-2B	
						Non-Fibers	100

**** Analytes in bold indicate asbestos mineral content.**

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	14-Dec-16

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Qualifier Notes

Sample Qualifiers :

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Work Order Revisions / Comments

None

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

15 - 6800 Kitimat Rd
Mississauga, ON, L5N 5M1
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

DST Consulting Engineers Inc. (Toronto)

3397 American Drive, #15
Mississauga, ON L4V 1T8
Attn: Justin Seedial

Client PO:
Project: GV TA 027833
Custody:

Report Date: 20-Dec-2017
Order Date: 15-Dec-2017

Order #: 1750428

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1750428-01	27833 03a - VFT- Office House bsmt locker room (VFT)
1750428-02	27833 03b - VFT- Office House bsmt locker room (VFT)
1750428-03	27833 03c - VFT- Office House bsmt locker room (VFT)
1750428-04	27833 03a - VFT- Office House bsmt locker room (mastic)
1750428-05	27833 03b - VFT- Office House bsmt locker room (mastic)
1750428-06	27833 03c - VFT- Office House bsmt locker room (mastic)
1750428-07	27833 04a - Paper - Office House bsmt boiler room
1750428-08	27833 04b - Paper - Office House bsmt boiler room
1750428-09	27833 04c - Paper - Office House bsmt boiler room
1750428-10	27833 05a - Brick Mortar - Office House bsmt Chimney
1750428-11	27833 05b - Brick Mortar - Office House bsmt Chimney
1750428-12	27833 05c - Brick Mortar - Office House bsmt Chimney
1750428-13	27833 06a - VFT - Office House supernumery cabin (VFT)
1750428-14	27833 06b - VFT - Office House supernumery cabin (VFT)
1750428-15	27833 06c - VFT - Office House supernumery cabin (VFT)
1750428-16	27833 06a - VFT - Office House supernumery cabin (mastic)
1750428-17	27833 06b - VFT - Office House supernumery cabin (mastic)
1750428-18	27833 06c - VFT - Office House supernumery cabin (mastic)
1750428-19	27833 07a - Plaster - Office House supernumery cabin (white plaster)
1750428-20	27833 07b - Plaster - Office House cabin 3 (white plaster)
1750428-21	27833 07c - Plaster - Office House cabin 4 (white plaster)
1750428-22	27833 07d - Plaster - Office House office archway (white plaster)
1750428-23	27833 07e - Plaster - Office House stairwell to bsmt (white plaster)
1750428-24	27833 07a - Plaster - Office House supernumery cabin (grey plaster)
1750428-25	27833 07b - Plaster - Office House cabin 3 (grey plaster)
1750428-26	27833 07c - Plaster - Office House cabin 4 (grey plaster)

Approved By:

Emma Diaz

Senior Analyst

1750428-27	27833 07d - Plaster - Office House office archway (grey plaster)
1750428-28	27833 07e - Plaster - Office House stairwell to bsmt (grey plaster)
1750428-29	27833 08a - VFT - Office House washroom under tile (VFT)
1750428-30	27833 08b - VFT - Office House washroom under tile (VFT)
1750428-31	27833 08c - VFT - Office House washroom under tile (VFT)
1750428-32	27833 08a - VFT- Office House washroom under tile (mastic paper)
1750428-33	27833 08b - VFT- Office House washroom under tile (mastic paper)
1750428-34	27833 08c - VFT- Office House washroom under tile (mastic paper)
1750428-35	27833 09a - DJC Office House washroom
1750428-36	27833 09b - DJC Office House washroom
1750428-37	27833 09c - DJC Office House washroom
1750428-38	27833 010a - Floor paper under hardwood office Hou
1750428-39	27833 010b - Floor paper under hardwood office Hou
1750428-40	27833 010c - Floor paper under hardwood office Hou
1750428-41	27833 011a - Textured ceiling Office House
1750428-42	27833 011b - Textured ceiling Office House
1750428-43	27833 011c - Textured ceiling Office House
1750428-44	27833 012a - Building paper Office House per. walls
1750428-45	27833 012b - Building paper Office House per. walls
1750428-46	27833 012c - Building paper Office House per. walls
1750428-47	27833 013a - Roofing material Office House
1750428-48	27833 013b - Roofing material Office House
1750428-49	27833 013c - Roofing material Office House
1750428-50	27833 014a - Fiberboard garage ext wall
1750428-51	27833 014b - Fiberboard garage ext wall
1750428-52	27833 014c - Fiberboard garage ext wall
1750428-53	27833 015a - DJC garage ceiling
1750428-54	27833 015b - DJC garage ceiling
1750428-55	27833 015c - DJC garage ceiling
1750428-56	27833 016a - DJC Fitness Room (breezeway)
1750428-57	27833 016b - DJC Fitness Room (breezeway)
1750428-58	27833 016c - DJC Fitness Room (breezeway)
1750428-59	27833 017a - Fiberboard washroom 2 wall ass. ext
1750428-60	27833 017b - Fiberboard washroom 2 wall ass. ext
1750428-61	27833 017c - Fiberboard washroom 2 wall ass. ext
1750428-62	27833 018a - DJC generator room
1750428-63	27833 018b - DJC generator room
1750428-64	27833 018c - DJC generator room
1750428-65	27833 019a - Canvas wrap generator cable
1750428-66	27833 019b - Canvas wrap generator cable
1750428-67	27833 019c - Canvas wrap generator cable
1750428-68	27833 020a - DJC Galley House living room
1750428-69	27833 020b - DJC Galley House living room
1750428-70	27833 020c - DJC Galley House living room

1750428-71	27833 021a - Fibreboard Galley House livin room ent
1750428-72	27833 021b - Fibreboard Galley House livin room ent
1750428-73	27833 021c - Fibreboard Galley House livin room ent
1750428-74	27833 022a - adhesive in plywood floor Galley livingro
1750428-75	27833 022b - adhesive in plywood floor Galley livingro
1750428-76	27833 022c - adhesive in plywood floor Galley livingro
1750428-77	27833 023a - VFT Galley House furnace room (VFT)
1750428-78	27833 023b - VFT Galley House furnace room (VFT)
1750428-79	27833 023c - VFT Galley House furnace room (VFT)
1750428-80	27833 023a - VFT Galley House furnace room (paper mastic)
1750428-81	27833 023b - VFT Galley House furnace room (paper mastic)
1750428-82	27833 023c - VFT Galley House furnace room (paper mastic)
1750428-83	27833 024a - Building paper Office House ext wall
1750428-84	27833 024b - Building paper Office House ext wall
1750428-85	27833 024c - Building paper Office House ext wall
1750428-86	27833 025a - Pebble dash stucco Office House ext
1750428-87	27833 025b - Pebble dash stucco Office House ext
1750428-88	27833 025c - Pebble dash stucco Office House ext
1750428-89	27833 026a - Caulking Office H. adj. metal flashing ext
1750428-90	27833 026b - Caulking Office H. adj. metal flashing ext
1750428-91	27833 026c - Caulking Office H. adj. metal flashing ext
1750428-92	27833 027a - Caulking Office house ext window
1750428-93	27833 027b - Caulking Office house ext window
1750428-94	27833 027c - Caulking Office house ext window
1750428-95	27833 028a - Caulking middle attach. adj stucco ext
1750428-96	27833 028b - Caulking middle attach. adj stucco ext
1750428-97	27833 028c - Caulking middle attach. adj stucco ext
1750428-98	27833 029a - VSF Storage Building (vinyl flooring)
1750428-99	27833 029b - VSF Storage Building (vinyl flooring)
1750428-AA	27833 029c - VSF Storage Building (vinyl flooring)
1750428-AB	27833 029a - VSF storage building (backing)
1750428-AC	27833 029b - VSF storage building (backing)
1750428-AD	27833 029c - VSF storage building (backing)
1750428-AE	27833 030a - Building paper Storage Building
1750428-AF	27833 030b - Building paper Storage Building
1750428-AG	27833 030c - Building paper Storage Building
1750428-AH	27833 031a - Roofing paper Storage Building
1750428-AI	27833 031b - Roofing paper Storage Building
1750428-AJ	27833 031c - Roofing paper Storage Building
1750428-AK	27833 032a - Roofing shingle Storage Building
1750428-AL	27833 032b - Roofing shingle Storage Building
1750428-AM	27833 032c - Roofing shingle Storage Building

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 20-Dec-2017

Order Date: 15-Dec-2017

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1750428-01	13-Dec-17	sample homogenized	Grey	Vinyl Floor Tile	No	Client ID: 27833 03a - VFT- Office House bsmt locker room (VFT)	
						Non-Fibers	100
1750428-02	13-Dec-17	sample homogenized	Grey	Vinyl Floor Tile	No	Client ID: 27833 03b - VFT- Office House bsmt locker room (VFT)	
						Non-Fibers	100
1750428-03	13-Dec-17	sample homogenized	Grey	Vinyl Floor Tile	No	Client ID: 27833 03c - VFT- Office House bsmt locker room (VFT)	
						Non-Fibers	100
1750428-04	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 03a - VFT- Office House bsmt locker room (mastic)	
						Non-Fibers	100
1750428-05	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 03b - VFT- Office House bsmt locker room (mastic)	
						Non-Fibers	100
1750428-06	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 03c - VFT- Office House bsmt locker room (mastic)	
						Non-Fibers	100
1750428-07	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 04a - Paper - Office House bsmt boiler room	
						Cellulose	60
						Non-Fibers	40
1750428-08	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 04b - Paper - Office House bsmt boiler room	
						Cellulose	60
						Non-Fibers	40
1750428-09	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 04c - Paper - Office House bsmt boiler room	
						Cellulose	60
						Non-Fibers	40
1750428-10	13-Dec-17	sample homogenized	Grey	Mortar	No	Client ID: 27833 05a - Brick Mortar - Office House bsmt Chimney	
						Non-Fibers	100
1750428-11	13-Dec-17	sample homogenized	Grey	Mortar	No	Client ID: 27833 05b - Brick Mortar - Office House bsmt Chimney	
						Non-Fibers	100
1750428-12	13-Dec-17	sample homogenized	Grey	Mortar	No	Client ID: 27833 05c - Brick Mortar - Office House bsmt Chimney	
						Non-Fibers	100
1750428-13	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 06a - VFT - Office House supernumery cabin (VFT)	
						Cellulose	15
						Non-Fibers	85
1750428-14	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 06b - VFT - Office House supernumery cabin (VFT)	
						Cellulose	15
						Non-Fibers	85

Certificate of Analysis

Report Date: 20-Dec-2017

Client: DST Consulting Engineers Inc. (Toronto)

Order Date: 15-Dec-2017

Client PO:

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1750428-15	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 06c - VFT - Office House supernumery cabin (VFT)	
						Cellulose	15
						Non-Fibers	85
1750428-16	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 06a - VFT - Office House supernumery cabin (mastic)	
						Cellulose	20
						Non-Fibers	80
1750428-17	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 06b - VFT - Office House supernumery cabin (mastic)	
						Cellulose	20
						Non-Fibers	80
1750428-18	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 06c - VFT - Office House supernumery cabin (mastic)	
						Cellulose	20
						Non-Fibers	80
1750428-19	13-Dec-17	sample homogenized	White	Plaster	No	Client ID: 27833 07a - Plaster - Office House supernumery cabin (white p	
						Non-Fibers	100
1750428-20	13-Dec-17	sample homogenized	White	Plaster	No	Client ID: 27833 07b - Plaster - Office House cabin 3 (white plaster)	
						Non-Fibers	100
1750428-21	13-Dec-17	sample homogenized	White	Plaster	No	Client ID: 27833 07c - Plaster - Office House cabin 4 (white plaster)	
						Non-Fibers	100
1750428-22	13-Dec-17	sample homogenized	White	Plaster	No	Client ID: 27833 07d - Plaster - Office House office archway (white plast	
						Non-Fibers	100
1750428-23	13-Dec-17	sample homogenized	White	Plaster	No	Client ID: 27833 07e - Plaster - Office House stairwell to bsmt (white pla	
						Non-Fibers	100
1750428-24	13-Dec-17	sample homogenized	Grey	Plaster	No	Client ID: 27833 07a - Plaster - Office House supernumery cabin (grey p	
						Non-Fibers	99
						Other fibers	1
1750428-25	13-Dec-17	sample homogenized	Grey	Plaster	No	Client ID: 27833 07b - Plaster - Office House cabin 3 (grey plaster)	
						Non-Fibers	99
						Other fibers	1
1750428-26	13-Dec-17	sample homogenized	Grey	Plaster	No	Client ID: 27833 07c - Plaster - Office House cabin 4 (grey plaster)	
						Non-Fibers	99
						Other fibers	1
1750428-27	13-Dec-17	sample homogenized	Grey	Plaster	No	Client ID: 27833 07d - Plaster - Office House office archway (grey plast	
						Non-Fibers	99
						Other fibers	1

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 20-Dec-2017

Order Date: 15-Dec-2017

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1750428-28	13-Dec-17	sample homogenized	Grey	Plaster	No	Client ID: 27833 07e - Plaster - Office House stairwell to bsmt (grey pla	
						Non-Fibers	99
						Other fibers	1
1750428-29	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 08a - VFT - Office House washroom under tile (VFT)	
						Cellulose	20
						Non-Fibers	80
1750428-30	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 08b - VFT - Office House washroom under tile (VFT)	
						Cellulose	20
						Non-Fibers	80
1750428-31	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 08c - VFT - Office House washroom under tile (VFT)	
						Cellulose	20
						Non-Fibers	80
1750428-32	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 08a - VFT- Office House washroom under tile (mastic pa	
						Cellulose	20
						Non-Fibers	80
1750428-33	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 08b - VFT- Office House washroom under tile (mastic pa	
						Cellulose	20
						Non-Fibers	80
1750428-34	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 08c - VFT- Office House washroom under tile (mastic pa	
						Cellulose	20
						Non-Fibers	80
1750428-35	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 09a - DJC Office House washroom	
						Non-Fibers	100
1750428-36	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 09b - DJC Office House washroom	
						Non-Fibers	100
1750428-37	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 09c - DJC Office House washroom	
						Non-Fibers	100
1750428-38	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 010a - Floor paper under hardwood office Hou	
						Cellulose	80
						Non-Fibers	20
1750428-39	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 010b - Floor paper under hardwood office Hou	
						Cellulose	80
						Non-Fibers	20

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 20-Dec-2017

Order Date: 15-Dec-2017

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1750428-40	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 010c - Floor paper under hardwood office Hou	
						Cellulose	80
						Non-Fibers	20
1750428-41	13-Dec-17	sample homogenized	White	Texture Coat	No	Client ID: 27833 011a - Textured ceiling Office House	
						Non-Fibers	100
1750428-42	13-Dec-17	sample homogenized	White	Texture Coat	No	Client ID: 27833 011b - Textured ceiling Office House	
						Non-Fibers	100
1750428-43	13-Dec-17	sample homogenized	White	Texture Coat	No	Client ID: 27833 011c - Textured ceiling Office House	
						Non-Fibers	100
1750428-44	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 012a - Building paper Office House per. walls	
						Cellulose	70
						MMVF	10
						Non-Fibers	20
1750428-45	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 012b - Building paper Office House per. walls	
						Cellulose	70
						MMVF	10
						Non-Fibers	20
1750428-46	13-Dec-17	sample homogenized	Brown	Paper	No	Client ID: 27833 012c - Building paper Office House per. walls	
						Cellulose	70
						MMVF	10
						Non-Fibers	20
1750428-47	13-Dec-17	sample homogenized	Black	Roofing Material	No	Client ID: 27833 013a - Roofing material Office House [AS-PRE]	
						Cellulose	20
						MMVF	20
						Non-Fibers	60
1750428-48	13-Dec-17	sample homogenized	Black	Roofing Material	No	Client ID: 27833 013b - Roofing material Office House [AS-PRE]	
						Cellulose	20
						MMVF	20
						Non-Fibers	60
1750428-49	13-Dec-17	sample homogenized	Black	Roofing Material	No	Client ID: 27833 013c - Roofing material Office House [AS-PRE]	
						Cellulose	20
						MMVF	20
						Non-Fibers	60

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 20-Dec-2017

Order Date: 15-Dec-2017

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1750428-50	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 014a - Fiberboard garage ext wall	
						Cellulose	90
						Non-Fibers	10
1750428-51	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 014b - Fiberboard garage ext wall	
						Cellulose	90
						Non-Fibers	10
1750428-52	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 014c - Fiberboard garage ext wall	
						Cellulose	90
						Non-Fibers	10
1750428-53	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 015a - DJC garage ceiling	
						Non-Fibers	100
1750428-54	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 015b - DJC garage ceiling	
						Non-Fibers	100
1750428-55	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 015c - DJC garage ceiling	
						Non-Fibers	100
1750428-56	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 016a - DJC Fitness Room (breezeway)	
						Non-Fibers	100
1750428-57	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 016b - DJC Fitness Room (breezeway)	
						Non-Fibers	100
1750428-58	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 016c - DJC Fitness Room (breezeway)	
						Non-Fibers	100
1750428-59	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 017a - Fiberboard washroom 2 wall ass. ext	
						Cellulose	90
						Non-Fibers	10
1750428-60	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 017b - Fiberboard washroom 2 wall ass. ext	
						Cellulose	90
						Non-Fibers	10
1750428-61	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 017c - Fiberboard washroom 2 wall ass. ext	
						Cellulose	90
						Non-Fibers	10
1750428-62	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 018a - DJC generator room	
						Non-Fibers	100
1750428-63	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 018b - DJC generator room	
						Non-Fibers	100

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 20-Dec-2017

Order Date: 15-Dec-2017

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1750428-64	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 018c - DJC generator room	
						Non-Fibers	100
1750428-65	13-Dec-17	sample homogenized	White	Canvas Wrap	No	Client ID: 27833 019a - Canvas wrap generator cable	
						MMVF	95
						Non-Fibers	5
1750428-66	13-Dec-17	sample homogenized	White	Canvas Wrap	No	Client ID: 27833 019b - Canvas wrap generator cable	
						MMVF	95
						Non-Fibers	5
1750428-67	13-Dec-17	sample homogenized	White	Canvas Wrap	No	Client ID: 27833 019c - Canvas wrap generator cable	
						MMVF	95
						Non-Fibers	5
1750428-68	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 020a - DJC Galley House living room	
						Non-Fibers	100
1750428-69	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 020b - DJC Galley House living room	
						Non-Fibers	100
1750428-70	13-Dec-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: 27833 020c - DJC Galley House living room	
						Non-Fibers	100
1750428-71	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 021a - Fibreboard Galley House livin room ent	
						Cellulose	85
						Non-Fibers	15
1750428-72	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 021b - Fibreboard Galley House livin room ent	
						Cellulose	85
						Non-Fibers	15
1750428-73	13-Dec-17	sample homogenized	Brown	Fiberboard	No	Client ID: 27833 021c - Fibreboard Galley House livin room ent	
						Cellulose	85
						Non-Fibers	15
1750428-74	13-Dec-17	sample homogenized	Black	Adhesive	**Yes**	Client ID: 27833 022a - adhesive in plywood floor Galley livingro	
						Chrysotile	1
						Non-Fibers	99
1750428-75	13-Dec-17					Client ID: 27833 022b - adhesive in plywood floor Galley livingro	
						not analyzed	
1750428-76	13-Dec-17					Client ID: 27833 022c - adhesive in plywood floor Galley livingro	
						not analyzed	

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 20-Dec-2017

Order Date: 15-Dec-2017

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1750428-77	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 023a - VFT Galley House furnace room (VFT)	
						Cellulose	20
						Non-Fibers	80
1750428-78	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 023b - VFT Galley House furnace room (VFT)	
						Cellulose	20
						Non-Fibers	80
1750428-79	13-Dec-17	sample homogenized	Brown	Vinyl Floor Tile	No	Client ID: 27833 023c - VFT Galley House furnace room (VFT)	
						Cellulose	20
						Non-Fibers	80
1750428-80	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 023a - VFT Galley House furnace room (paper mastic)	
						Cellulose	20
						Non-Fibers	80
1750428-81	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 023b - VFT Galley House furnace room (paper mastic)	
						Cellulose	20
						Non-Fibers	80
1750428-82	13-Dec-17	sample homogenized	Black	Mastic	No	Client ID: 27833 023c - VFT Galley House furnace room (paper mastic)	
						Cellulose	20
						Non-Fibers	80
1750428-83	13-Dec-17	sample homogenized	Black	Paper	No	Client ID: 27833 024a - Building paper Office House ext wall	
						Cellulose	85
						Non-Fibers	15
1750428-84	13-Dec-17	sample homogenized	Black	Paper	No	Client ID: 27833 024b - Building paper Office House ext wall	
						Cellulose	85
						Non-Fibers	15
1750428-85	13-Dec-17	sample homogenized	Black	Paper	No	Client ID: 27833 024c - Building paper Office House ext wall	
						Cellulose	85
						Non-Fibers	15
1750428-86	13-Dec-17	sample homogenized	Grey	Stucco	No	Client ID: 27833 025a - Pebble dash stucco Office House ext	
						Non-Fibers	100
1750428-87	13-Dec-17	sample homogenized	Grey	Stucco	No	Client ID: 27833 025b - Pebble dash stucco Office House ext	
						Non-Fibers	100
1750428-88	13-Dec-17	sample homogenized	Grey	Stucco	No	Client ID: 27833 025c - Pebble dash stucco Office House ext	
						Non-Fibers	100
1750428-89	13-Dec-17	sample homogenized	Grey	Caulking	No	Client ID: 27833 026a - Caulking Office H. adj. metal flashing ext	
						Non-Fibers	100

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 20-Dec-2017

Order Date: 15-Dec-2017

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1750428-90	13-Dec-17	sample homogenized	Grey	Caulking	No	Client ID: 27833 026b - Caulking Office H. adj. metal flashing ext	
						Non-Fibers	100
1750428-91	13-Dec-17	sample homogenized	Grey	Caulking	No	Client ID: 27833 026c - Caulking Office H. adj. metal flashing ext	
						Non-Fibers	100
1750428-92	13-Dec-17	sample homogenized	White	Caulking	No	Client ID: 27833 027a - Caulking Office house ext window	
						Non-Fibers	100
1750428-93	13-Dec-17	sample homogenized	White	Caulking	No	Client ID: 27833 027b - Caulking Office house ext window	
						Non-Fibers	100
1750428-94	13-Dec-17	sample homogenized	White	Caulking	No	Client ID: 27833 027c - Caulking Office house ext window	
						Non-Fibers	100
1750428-95	13-Dec-17	sample homogenized	White	Caulking	No	Client ID: 27833 028a - Caulking middle attach. adj stucco ext	
						Non-Fibers	100
1750428-96	13-Dec-17	sample homogenized	White	Caulking	No	Client ID: 27833 028b - Caulking middle attach. adj stucco ext	
						Non-Fibers	100
1750428-97	13-Dec-17	sample homogenized	White	Caulking	No	Client ID: 27833 028c - Caulking middle attach. adj stucco ext	
						Non-Fibers	100
1750428-98	13-Dec-17	sample homogenized	Green	Vinyl Sheet Flooring	No	Client ID: 27833 029a - VSF Storage Building (vinyl flooring)	
						Cellulose	30
						Non-Fibers	70
1750428-99	13-Dec-17	sample homogenized	Green	Vinyl Sheet Flooring	No	Client ID: 27833 029b - VSF Storage Building (vinyl flooring)	
						Cellulose	30
						Non-Fibers	70
1750428-AA	13-Dec-17	sample homogenized	Green	Vinyl Sheet Flooring	No	Client ID: 27833 029c - VSF Storage Building (vinyl flooring)	
						Cellulose	30
						Non-Fibers	70
1750428-AB	13-Dec-17	sample homogenized	Brown	Vinyl Sheet Flooring Backing	No	Client ID: 27833 029a - VSF storage building (backing)	
						Cellulose	85
						Non-Fibers	15
1750428-AC	13-Dec-17	sample homogenized	Brown	Vinyl Sheet Flooring Backing	No	Client ID: 27833 029b - VSF storage building (backing)	
						Cellulose	85
						Non-Fibers	15
1750428-AD	13-Dec-17	sample homogenized	Brown	Vinyl Sheet Flooring Backing	No	Client ID: 27833 029c - VSF storage building (backing)	
						Cellulose	85
						Non-Fibers	15

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 20-Dec-2017

Order Date: 15-Dec-2017

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1750428-AE	13-Dec-17	sample homogenized	Brown	Paper	No	**Client ID: 27833 030a - Building paper Storage Building**	
						Cellulose	70
						MMVF	10
						Non-Fibers	20
1750428-AF	13-Dec-17	sample homogenized	Brown	Paper	No	**Client ID: 27833 030b - Building paper Storage Building**	
						Cellulose	70
						MMVF	10
						Non-Fibers	20
1750428-AG	13-Dec-17	sample homogenized	Brown	Paper	No	**Client ID: 27833 030c - Building paper Storage Building**	
						Cellulose	70
						MMVF	10
						Non-Fibers	20
1750428-AH	13-Dec-17	sample homogenized	Black	Roofing paper	No	**Client ID: 27833 031a - Roofing paper Storage Building** [AS-PRE]	
						Cellulose	65
						Non-Fibers	35
1750428-AI	13-Dec-17	sample homogenized	Black	Roofing paper	No	**Client ID: 27833 031b - Roofing paper Storage Building** [AS-PRE]	
						Cellulose	65
						Non-Fibers	35
1750428-AJ	13-Dec-17	sample homogenized	Black	Roofing paper	No	**Client ID: 27833 031c - Roofing paper Storage Building** [AS-PRE]	
						Cellulose	65
						Non-Fibers	35
1750428-AK	13-Dec-17	sample homogenized	Black	Shingle	No	**Client ID: 27833 032a - Roofing shingle Storage Building** [AS-PRE]	
						Cellulose	30
						Non-Fibers	70
1750428-AL	13-Dec-17	sample homogenized	Black	Shingle	No	**Client ID: 27833 032b - Roofing shingle Storage Building** [AS-PRE]	
						Cellulose	30
						Non-Fibers	70
1750428-AM	13-Dec-17	sample homogenized	Black	Shingle	No	**Client ID: 27833 032c - Roofing shingle Storage Building** [AS-PRE]	
						Cellulose	30
						Non-Fibers	70

** MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool*

**** Analytes in bold indicate asbestos mineral content.**

Certificate of Analysis

Report Date: 20-Dec-2017

Client: DST Consulting Engineers Inc. (Toronto)

Order Date: 15-Dec-2017

Client PO:

Project Description: GV TA 027833

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	19-Dec-17

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Qualifier Notes

Sample Qualifiers :

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Work Order Revisions / Comments

None

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

DST Consulting Engineers Inc. (Toronto)

3397 American Drive, #15
Mississauga, ON L4V 1T8
Attn: Justin Seedial

Client PO:
Project: GV TA 027833
Custody: 114979

Report Date: 19-Dec-2017
Order Date: 15-Dec-2017

Order #: 1750419

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1750419-01	27833-L010 - Office House grey floor paint bsmt

Approved By:

Tim McCooeye
Senior Advisor

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Toronto)
Client PO:

Report Date: 19-Dec-2017
Order Date: 15-Dec-2017
Project Description: GV TA 027833

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Metals, ICP-OES	based on MOE E3470, ICP-OES	18-Dec-17	18-Dec-17

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Toronto)
Client PO:

Report Date: 19-Dec-2017
Order Date: 15-Dec-2017
Project Description: GV TA 027833

Sample Results

Lead

Matrix: Paint
Sample Date: 13-Dec-17

Paracel ID	Client ID	Units	MDL	Result
1750419-01	27833-L010 - Office House grey floor paint bsmt	ug/g	20	3840

Laboratory Internal QA/QC

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Matrix Blank									
Lead	**ND**	**20**	**ug/g**						
Matrix Duplicate									
Lead	**12500**	**20**	**ug/g**	**13200**			**5.8**	**30**	
Matrix Spike									
Lead	247		ug/L		98.8	70-130			

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

15 - 6800 Kitimat Rd
Mississauga, ON, L5N 5M1
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

DST Consulting Engineers Inc. (Toronto)

3397 American Drive, #15
Mississauga, ON L4V 1T8
Attn: Justin Seedial

Client PO:
Project: GV TA 027833
Custody: 25752

Report Date: 8-Jan-2018
Order Date: 4-Jan-2018

Order #: 1801181

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1801181-01	27833 033a-Roof Material / overhang garage (tar paper)
1801181-02	27833 033b-Roof Material / overhang garage (tar paper)
1801181-03	27833 033c-Roof Material / overhang garage (tar paper)
1801181-04	27833 033a-Roof Material / overhang garage (paper)
1801181-05	27833 033b-Roof Material / overhang garage (paper)
1801181-06	27833 033c-Roof Material / overhang garage (paper)
1801181-07	27833 033a-Roof Material / overhang garage (plastic)
1801181-08	27833 033b-Roof Material / overhang garage (plastic)
1801181-09	27833 033c-Roof Material / overhang garage (plastic)
1801181-10	27833 034a-Roof Material / Breezing (tar)
1801181-11	27833 034b-Roof Material / 1931 House(tar)
1801181-12	27833 034c-Roof Material / 1931 House (tar)
1801181-13	27833 034a-Roof Material / Breezing (tar paper)
1801181-14	27833 034b-Roof Material / 1931 House (tar paper)
1801181-15	27833 034c-Roof Material / 1931 House (tar paper)
1801181-16	27833 034a-Roof Material / Breezing (paper)
1801181-17	27833 034b-Roof Material / 1931 House (paper)
1801181-18	27833 034c-Roof Material / 1931 House (paper)
1801181-19	27833 034a-Roof Material / Breezing (plastic)
1801181-20	27833 034b-Roof Material / 1931 House (plastic)
1801181-21	27833 034c-Roof Material / 1931 House (plastic)
1801181-22	27833 034a-Roof Material / Breezing (foam)
1801181-23	27833 034b-Roof Material / 1931 House (foam)
1801181-24	27833 034c-Roof Material / 1931 House (foam)

Approved By:

Emma Diaz

Senior Analyst

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 08-Jan-2018

Order Date: 4-Jan-2018

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1801181-01	04-Jan-18	sample homogenized	Black	Tar Paper	No	Client ID: 27833 033a-Roof Material / overhang garage (tar paper) [AS-PRE]	
						Cellulose	80
						Non-Fibers	20
1801181-02	04-Jan-18	sample homogenized	Black	Tar Paper	No	Client ID: 27833 033b-Roof Material / overhang garage (tar paper) [AS-PRE]	
						Cellulose	80
						Non-Fibers	20
1801181-03	04-Jan-18	sample homogenized	Black	Tar Paper	No	Client ID: 27833 033c-Roof Material / overhang garage (tar paper) [AS-PRE]	
						Cellulose	80
						Non-Fibers	20
1801181-04	04-Jan-18	sample homogenized	Brown	Paper	No	Client ID: 27833 033a-Roof Material / overhang garage (paper) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1801181-05	04-Jan-18	sample homogenized	Brown	Paper	No	Client ID: 27833 033b-Roof Material / overhang garage (paper) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1801181-06	04-Jan-18	sample homogenized	Brown	Paper	No	Client ID: 27833 033c-Roof Material / overhang garage (paper) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1801181-07	04-Jan-18	sample homogenized	Black/White	Plastic	No	Client ID: 27833 033a-Roof Material / overhang garage (plastic) [AS-PRE]	
						MMVF	5
						Non-Fibers	95
1801181-08	04-Jan-18	sample homogenized	Black/White	Plastic	No	Client ID: 27833 033b-Roof Material / overhang garage (plastic) [AS-PRE]	
						MMVF	5
						Non-Fibers	95
1801181-09	04-Jan-18	sample homogenized	Black/White	Plastic	No	Client ID: 27833 033c-Roof Material / overhang garage (plastic) [AS-PRE]	
						MMVF	5
						Non-Fibers	95
1801181-10	04-Jan-18	sample homogenized	Black	Tar	No	Client ID: 27833 034a-Roof Material / Breezing (tar) [AS-PRE]	
						Non-Fibers	100
1801181-11	04-Jan-18	sample homogenized	Black	Tar	Yes	Client ID: 27833 034b-Roof Material / 1931 House(tar) [AS-PRE]	
						[ASTrc] **Chrysotile**	<MDL
						Non-Fibers	100
1801181-12	04-Jan-18	sample homogenized	Black	Tar	No	Client ID: 27833 034c-Roof Material / 1931 House (tar) [AS-PRE]	
						Non-Fibers	100

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 08-Jan-2018

Order Date: 4-Jan-2018

Project Description: GV TA 027833

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1801181-13	04-Jan-18	sample homogenized	Black	Tar Paper	No	Client ID: 27833 034a-Roof Material / Breezing (tar paper) [AS-PRE]	
						Cellulose	40
						Non-Fibers	60
1801181-14	04-Jan-18	sample homogenized	Black	Tar Paper	No	Client ID: 27833 034b-Roof Material / 1931 House (tar paper) [AS-PRE]	
						Cellulose	40
						Non-Fibers	60
1801181-15	04-Jan-18	sample homogenized	Black	Tar Paper	No	Client ID: 27833 034c-Roof Material / 1931 House (tar paper) [AS-PRE]	
						Cellulose	40
						Non-Fibers	60
1801181-16	04-Jan-18	sample homogenized	Brown	Paper	No	Client ID: 27833 034a-Roof Material / Breezing (paper) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1801181-17	04-Jan-18	sample homogenized	Brown	Paper	No	Client ID: 27833 034b-Roof Material / 1931 House (paper) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1801181-18	04-Jan-18	sample homogenized	Brown	Paper	No	Client ID: 27833 034c-Roof Material / 1931 House (paper) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1801181-19	04-Jan-18	sample homogenized	Black/White	Plastic	No	Client ID: 27833 034a-Roof Material / Breezing (plastic) [AS-PRE]	
						Non-Fibers	100
1801181-20	04-Jan-18	sample homogenized	Black/White	Plastic	No	Client ID: 27833 034b-Roof Material / 1931 House (plastic) [AS-PRE]	
						Non-Fibers	100
1801181-21	04-Jan-18	sample homogenized	Black/White	Plastic	No	Client ID: 27833 034c-Roof Material / 1931 House (plastic) [AS-PRE]	
						Non-Fibers	100
1801181-22	04-Jan-18	sample homogenized	Yellow	Foam	No	Client ID: 27833 034a-Roof Material / Breezing (foam) [AS-PRE]	
						Non-Fibers	100
1801181-23	04-Jan-18	sample homogenized	Yellow	Foam	No	Client ID: 27833 034b-Roof Material / 1931 House (foam) [AS-PRE]	
						Non-Fibers	100
1801181-24	04-Jan-18	sample homogenized	Yellow	Foam	No	Client ID: 27833 034c-Roof Material / 1931 House (foam) [AS-PRE]	
						Non-Fibers	100

** MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool*

**** Analytes in bold indicate asbestos mineral content.**

Certificate of Analysis

Report Date: 08-Jan-2018

Client: DST Consulting Engineers Inc. (Toronto)

Order Date: 4-Jan-2018

Client PO:

Project Description: GV TA 027833

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	5-Jan-18

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Qualifier Notes

Sample Qualifiers :

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

ASTrc: Trace asbestos was observed below the noted detection limit but could not be accurately quantified.

Work Order Revisions / Comments

None

APPENDIX B

Representative Photographs

Photo 1: View of loose Fluorescent tubes

Photo 2: View of an exterior fuel storage tank, observed on the property

Photo 3: View of the exterior of the Galley House and Office House, where asbestos containing caulking on the main floor windows and basement windows were observed. All caulking was observed to be in good condition at the time of the assessment.

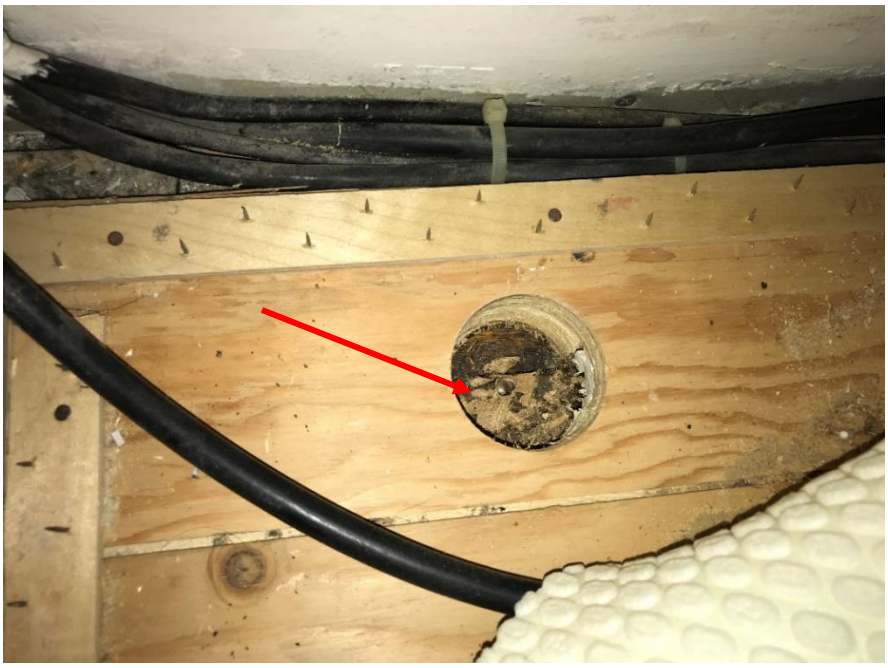


Photo 4: View of black mastic applied to plywood subfloor in living room of Galley House. This mastic is assumed present beneath plywood sheeting throughout all areas of the Galley House, unless proven otherwise.

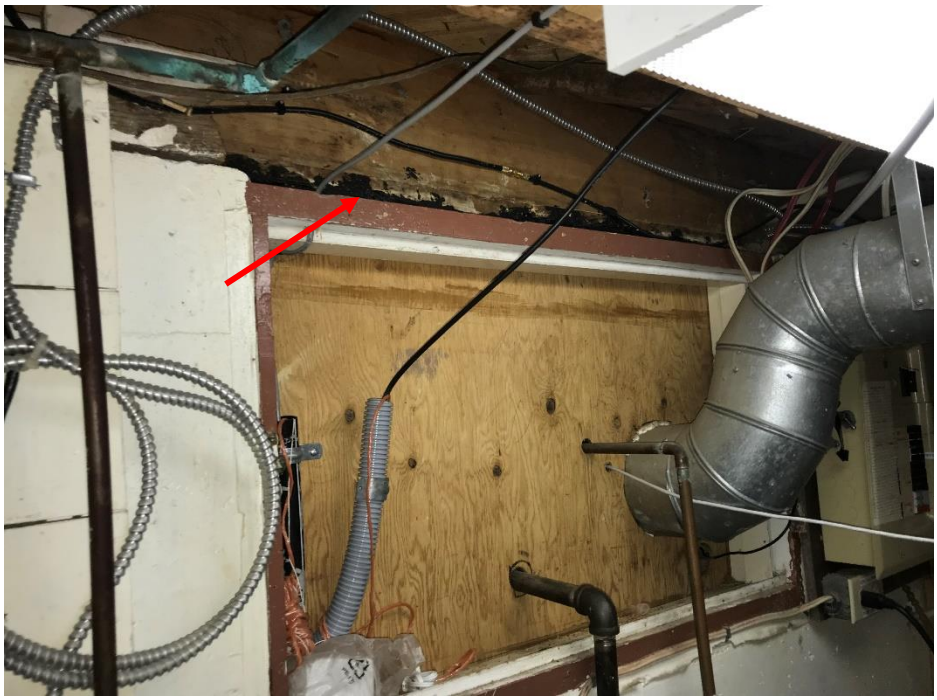


Photo 5: View of Tar on wall in basement boiler room of the Office House.

APPENDIX C

ACM Database

ASBESTOS-CONTAINING MATERIAL INVENTORY

Location							Approx. Quantity				
Floor	Room/Area	System	Description	Condition	Access	Friability	num	unit	Action	Priority	Additional Notes
Office House											
B	Water Treatment Room	Wall	Tar	Good	A	Non-Friable	3	Linear Metres	7	Low	
Galley House											
1	Throughout Ground Level	Floor	Mastic under/between Plywood	Good	D	Non-Friable	Throughout	N/A	7	Low	
Exterior											
1	Exterior	Windows	Caulking	Good	B	Non-Friable	175	Linear metres	7	Low	
B	Exterior	Windows	Caulking	Good	B	Non-Friable	5	Linear Metres	7	Low	

Legend

CONDITION:

GOOD - Completely encapsulated, no signs of damage, deterioration, or delamination
FAIR - Minor damage or penetration or ACM that has never been covered.
POOR - Original cover or jacket is damaged or missing. ACM is exposed and amount of missing
DEBRIS - Presence of fallen ACM. Major damage and no longer attached to its

ACCESSIBILITY:

A - Areas of the building that are accessible to all building occupants
B - Areas of the building that are accessible to Maintenance and Operations staff only, without the need of a ladder
Ce - Areas of the building above 2.5 metres where use of a ladder is required to reach the ACM. ACM is exposed from floor level or ladder, without removing other building component
Cc - Area of the building which require the removal of a building component, including ceiling tile or access panel into solid ceiling.
D - Areas of the building that are behind solid ceilings systems or within wall and ceiling cavities (e.g. areas where building material demolition is required to obtain access).

PRIORITY (ACTION LEVEL)

1 - IMMEDIATE CLEAN UP OF ACM DEBRIS
2 - PRECAUTIONS FOR ACCESS WHICH MAY DISTURB ACM DEBRIS
3 - ACM REMOVAL
4 - PRECAUTIONS FOR WORK WHICH MAY DISTURB ACM IN POOR CONDITION
5 - PROACTIVE ACM REMOVAL
6 - ACM REPAIR
7 - MANANAGEMENT PROGRAM AND SURVEILLANCE

	Good	Fair	Poor	Debris
A	5/7	5/6	3	1
B	7	6/5	3	1
Ce	7	6	4	2
Cc	7	7	4	2
D	7	7	7	7

General Notes:

1. Asbestos disturbance, abatement, transportation, and disposal shall be performed in accordance with requirements of O.Reg. 278/05, Canada Labour Code OHSR, PSPC Asbestos Management Standard, O.Reg. 347/90, as amended, and TDGA. IN the event of conflict, the more stringent procedures shall apply.

2. Conditions, and locations of asbestos-containing materials are to be confirmed on-site prior to removal or disturbance.

3. Condition, Access, Friability and Recommended Action for each material is based upon the definitions outlined within the PSPC Asbestos Management Standard

DESIGNATED SUBSTANCES AND HAZARDOUS BUILDING MATERIALS ASSESSMENT

Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin

North Storage Shed and North Storage Bin
Port Weller Search and Rescue Station
Port Weller ON

Stantec

Prepared for:
Public Services and Procurement Canada
4900 Yonge Street
Toronto ON M2N 6A6

Prepared by:
Stantec Consulting Ltd.
300W – 675 Cochrane Drive
Markham ON L3R 0B8

Project No.: 122150683

July 13, 2018

Table of Contents

LIST OF TABLES

LIST OF APPENDICES

Executive Summary

Stantec Consulting Ltd. (Stantec) was commissioned by Public Works and Government Services Canada (PWGSC) on behalf of Fisheries and Oceans Canada (DFO) to conduct a designated substances and hazardous building materials assessment of the north storage shed and north storage bin at the Port Weller Search and Rescue Station (Subject Area) located in Port Weller, Ontario.

The purpose of the assessment was to identify potential designated substances and hazardous building materials that may require special attention prior to the planned demolition activities. The work was carried out in accordance with the requirements of the Ontario *Occupational Health and Safety Act* (OHSA). The *Canada Labour Code* also stipulates in Part II that every employer shall ensure that the health and safety at work of every person employed by the employer is protected. The Port Weller Search and Rescue Station is a federal site.

The designated substances assessment list includes those substances designated under the OHSA and included asbestos, lead, mercury, and silica as the most likely to be present. In addition to designated substances, the hazardous building materials considered in this assessment included: polychlorinated biphenyls (PCBs); ozone-depleting substances (ODSs); urea-formaldehyde foam insulation (UFFI); mould; and, radioactive sources. A visual assessment was also conducted for chemical, fuel, oil and/or waste oil storage and for treated lumber applications that could contain creosote or arsenic.

Based on the visual assessment and laboratory analysis, designated substances and hazardous building materials were identified to be present. Table 1 below provides a summary of the materials identified and recommendations on their management.

Table 1: Summary of Findings

Building Materials	Comments
Asbestos	Friable building materials suspected to be asbestos-containing were identified by laboratory analysis to be non-asbestos-containing. Non-friable building materials suspected to be asbestos-containing were identified by laboratory analysis to be non-asbestos-containing. Presumed asbestos-containing materials were not observed to be present.
Lead	One sample of a paint application was collected from the north storage shed and submitted for lead content analysis. The white coloured paint on the exterior of the north storage shed was identified to contain lead below 90 ppm. The paint application was observed to be in good condition.
Mercury	Mercury vapour is likely to be present in the eight fluorescent light tubes observed. Mercury may also be present in some paints and adhesives.
Silica	The presence of silica in building materials such as concrete was noted.

Table 1: Summary of Findings

Building Materials	Comments
Polychlorinated Biphenyls (PCBs)	PCBs may be present in the fluorescent light ballasts of the four light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. Polychlorinated Biphenyls may also be present in plastics, applied dried paints, coatings, or sealants, caulking, adhesives, paper, or insulation.
Ozone-Depleting Substance (ODS)	Suspect building related cooling and refrigeration equipment suspected to be ODS-containing was not observed.
Mould	Suspect mould was not observed at the time of the assessment.
Urea Formaldehyde Foam Insulation (UFFI)	Evidence of the application of UFFI was not observed.
Other Designated Substances	Acrylonitrile, benzene, coke oven emissions, ethylene oxides, isocyanates, and vinyl chloride are not typically a concern in building materials, and therefore these substances were not investigated.
Radioactive Sources	Evidence of radioactive sources was not observed.
Chemical, Fuel Oil and/or Waste Oil Storage	No evidence of underground storage tanks, significant chemical storage, or dumping was observed in the building assessed.
Arsenic	Treated lumber applications associated with the buildings assessed were not observed.
Creosote	Treated lumber applications associated with the buildings assessed were not observed.

The statements made in this Executive Summary text are subject to the same limitations included in this report and are to be read in conjunction with the remainder of this report.

Recommendations pertaining to the handling, removal, disposal and management of identified designated substances and hazardous building materials are provided within this report.

DESIGNATED SUBSTANCES AND HAZARDOUS BUILDING MATERIALS ASSESSMENT – NORTH STORAGE SHED AND NORTH STORAGE BIN

July 13, 2018

1.0 Introduction

Stantec Consulting Ltd. (Stantec) was commissioned by Public Works and Government Services Canada (PWGSC) on behalf of Fisheries and Oceans Canada (DFO) to conduct a designated substances and hazardous building materials assessment of the north storage shed and north storage bin at the Port Weller Search and Rescue Station (Subject Area) located in Port Weller, Ontario.

The purpose of the assessment was to identify potential designated substances and hazardous building materials that may require special attention prior to the planned demolition activities. The work was carried out in accordance with the requirements of the Ontario *Occupational Health and Safety Act* (OHSA). The *Canada Labour Code* also stipulates in Part II that every employer shall ensure that the health and safety at work of every person employed by the employer is protected. The Port Weller Search and Rescue Station is a federal site.

The designated substances assessment list includes those substances designated under the OHSA and included asbestos, lead, mercury, and silica as the most likely to be present. In addition to designated substances, the hazardous building materials considered in this assessment included: polychlorinated biphenyls (PCBs); ozone-depleting substances (ODSs); urea-formaldehyde foam insulation (UFFI); mould; and, radioactive sources. A visual assessment was also conducted for chemical, fuel, oil and/or waste oil storage and for treated lumber applications that could contain creosote or arsenic.

The site work was conducted by Michael Shortt on May 29, 2018.

2.0 Scope

The scope of work for this assessment involved the following:

- A review of existing information, including site drawings, previous assessment and/or abatement documentation and discussions with site personnel, where available
- A visual assessment of readily accessible areas for the presence of designated substances and hazardous building materials
- The collection of representative bulk samples from building materials suspected of containing asbestos fibres
- The collection of paint chip samples for the determination of the lead content in paint finishes
- Submission of samples collected for laboratory analysis
- Evaluation and interpretation of field findings and analytical results to develop conclusions and recommendations pertaining to designated substances and hazardous building materials identified to be present

2.1 BACKGROUND

Public Works and Government Services Canada on behalf of DFO commissioned this assessment as a measure of diligence in maintaining compliance with provincial regulations pertaining to the identification of designated substances and hazardous materials prior to demolition activities and the Canadian Occupational Health and Safety Regulations as this is a federal site.

Port Weller Search and Rescue Station is located in Port Weller, Ontario and consists of six (6) buildings. Stantec assessed the north storage shed and north storage bin as part of this assessment. The typical structural components and finishes associated with the north storage shed consist of vinyl and wood siding, vinyl sheet flooring and shingled roof. The north storage bin consists of a metal sided storage bin.

Stantec reviewed the previous report(s) outlined herein for information purposes only. Although the information provided in the documentation was reviewed and considered in developing our sampling plan, Stantec did not rely on the documentation or the sample analytical results within.

The following documentation was reviewed prior to undertaking the assessment:

- *Project-Specific Designated Substances Survey, Search and Rescue Station, Port Weller, Ontario*, dated February 21, 2018, and prepared DST Consulting Engineers.

3.0 Designated Substances and Hazardous Building Materials Assessment

This report reflects the observations made within accessed areas and the results of analyses performed on specific materials sampled, as indicated herein. Analytical results reflect the sampled materials at the specific sampling locations.

Sampling was conducted pertaining to suspected ACMs and suspected lead-containing paints (LCPs) only. The assessment for the presence of other designated substances and hazardous building materials was visual in nature and was conducted pertaining to readily visible surfaces within accessible spaces only.

The results of the assessment for each of the considered designated substances and hazardous materials are provided in the following sub-sections Refer to **Appendix A** for regulatory framework and relevant legislation with respect to designated substances and hazardous building materials. Selected site photographs are provided in **Appendix B**.

3.1 ASBESTOS

3.1.1 Methodology

It is Stantec's understanding that the buildings were constructed prior to1990. This construction time period is consistent with those dates when asbestos-containing building materials were commonly used.

A visual assessment of accessible areas was undertaken in order to check for the presence of materials suspected of containing asbestos. Locations to collect discrete bulk asbestos samples of suspect building materials were identified. Samples of representative materials were then collected at these locations. Samples were collected in accordance with the minimum sampling requirements for homogeneous materials set out in table 1 in O. Reg. 278/05.

A visual assessment of the condition and accessibility was completed for each occurrence of an ACM. The Public Services and Procurement Canada (PSPC) document entitled *Asbestos Management Standard* date June 2017 was used as the basis for the criteria that was applied in evaluating the presence of ACMs, where applicable.

Samples of suspect ACMs from various building materials were collected and submitted to EMSL Canada Inc. (EMSL), located in Mississauga, ON for analysis using Polarized Light Microscopy (PLM) with dispersion staining. The analysis was conducted following the U.S. EPA/600/R-93/116 Method. EMSL is certified under the National Voluntary Laboratory Accreditation Program (NVLAP) to perform asbestos analysis of bulk samples. ACMs in Ontario are defined as a material that contains 0.5 per cent or more asbestos by dry weight.

A positive stop option was used during the analysis of samples. Multiple samples of visually similar material were collected and submitted for laboratory analysis. Once a sample within the set was identified to contain asbestos, further analysis of the subsequent samples was deemed to be unnecessary and not conducted.

3.1.2 Findings

A summary list of the bulk samples collected during this assessment and confirmed to be ACM or non-ACMs by laboratory analysis is provided in the table below.

Table 2: Summary of Results of Analysis of Bulk Samples for Asbestos

Sample Number	Sampling Location	Description	Asbestos Content
BS-01A	North Storage Shed - interior	Interior Door Caulking - Grey	None Detected
BS-01B	North Storage Shed - interior	Interior Door Caulking - Grey	None Detected
BS-01C	North Storage Shed - interior	Interior Door Caulking - Grey	None Detected
BS-02A-FIBER	North Storage Shed - interior	Vinyl Sheet Flooring - Grey	None Detected
BS-02A-VINYL SHEET FLOORING	North Storage Shed - interior	Vinyl Sheet Flooring - Grey	None Detected

Table 2: Summary of Results of Analysis of Bulk Samples for Asbestos

Sample Number	Sampling Location	Description	Asbestos Content
BS-02B-FIBER	North Storage Shed - interior	Vinyl Sheet Flooring - Grey	None Detected
BS-02B-VINYL SHEET FLOORING	North Storage Shed - interior	Vinyl Sheet Flooring - Grey	None Detected
BS-02C-FIBER	North Storage Shed - interior	Vinyl Sheet Flooring - Grey	None Detected
BS-02C-VINYL SHEET FLOORING	North Storage Shed - interior	Vinyl Sheet Flooring - Grey	None Detected
BS-03A	North Storage Shed - Roof	Roofing Materials - Shingles	None Detected
BS-03B	North Storage Shed - Roof	Roofing Materials - Shingles	None Detected
BS-03C	North Storage Shed - Roof	Roofing Materials - Shingles	None Detected
BS04A	North Storage Bin	Exterior Caulking - Grey	None Detected
BS04B	North Storage Bin	Exterior Caulking - Grey	None Detected
BS04C	North Storage Bin	Exterior Caulking - Grey	None Detected

Floor plans showing the locations of bulk samples are provided in **Appendix C**. A copy of the laboratory Certificate of Analysis is provided in **Appendix D**. The evaluation criterion for assessing ACMs is provided in **Appendix F**.

3.1.2.1 Friable Asbestos-Containing Materials

Friable building materials suspected to be asbestos-containing were identified by laboratory analysis to be non-asbestos-containing.

3.1.2.2 Non-Friable Asbestos-Containing Materials

Non-friable building materials suspected to be asbestos-containing were identified by laboratory analysis to be non-asbestos-containing.

3.1.2.3 Presumed Asbestos-Containing Materials

Presumed asbestos-containing building materials were not observed to be present.

3.1.2.4 Potential for Vermiculite Insulation

Based on building construction vermiculite is not suspected to be present.

3.1.3 Recommendations

No further actions are required as asbestos-containing materials were not identified.

Should a material suspected to contain asbestos fibres become uncovered during demolition activities, all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if asbestos fibres are present. Confirmed asbestos materials should be handled accordingly in accordance with O. Reg 278/05.

3.2 LEAD

3.2.1 Methodology

A visual assessment of accessible areas was undertaken in order to check for the presence of materials that may contain lead. These materials included paint applications, wiring and plumbing etc.

Representative paint samples were collected and submitted to EMSL Canada Inc. (EMSL) located in Mississauga, Ontario for lead content analysis by Flame Atomic Absorption Spectrophotometry, following US EPA Method No. 7420.

The sampling of paint applications involved the collection of paint chip samples of paint layers to the substrate. A minimum volume of 5 cc or ½ teaspoon of paint chips was typically collected. Wherever necessary and possible, paint was separated from any backing material such as paper, concrete or wood and placed in a sealed clearly labelled plastic bag.

Samples of paint applications suspected to contain lead were collected from surfaces of major paint applications where visually different paint colours and/or types were identified. Although the surfaces where samples were collected may be covered with more than one coat of paint, the paint samples are described by the surface (visible) colour only. Attempts were made to represent all layers of paint in the samples collected. As analytical results are referenced to the surface paint colour only, the lead content of all painted surfaces similar to that represented by the surface paint colour will be presumed to be the same, regardless of differing sub surface paints, if any.

3.2.2 Findings

A summary list of the samples collected including a description of the samples, sampling locations and laboratory analytical results is provided in the table below.

Table 3: Summary of Results of Analysis of Paint Chip Samples for Lead

Sample Number	Sampling Location	Description	Lead Content (ppm)
PS-01	North Storage Shed, Exterior Wall	White Coloured Paint	<86 ppm

The sampling locations are indicated on the floor plans provided in **Appendix C**. A copy of the laboratory Certificate of Analysis for the paint chip testing is included in **Appendix E**.

One sample of a paint application was collected in the form of paint chip sample and submitted to EMSL for lead content analysis. PWGSC uses 90 ppm as the criteria to manage paint applications as lead-containing paints.

Based on the laboratory results, the white coloured paint on the walls of the north storage shed was identified to have a lead concentration of <0.86 ppm.

3.2.3 Recommendations

Lead containing paint applications were not identified. No recommendations are provided.

3.3 MERCURY

3.3.1 Methodology

An assessment for equipment, which is likely to contain mercury, was completed. Information on the type of equipment (i.e., gauges, switches, batteries, thermometers, etc.), model and serial numbers and quantities was recorded, where available.

3.3.2 Findings

Mercury vapour is likely to be present in the eight fluorescent light tubes observed.

3.3.3 Recommendations

Mercury vapour within light fixtures poses no risk to workers or occupants provided the mercury containers remain intact and undisturbed. Complete removal of mercury-containing equipment is required prior to demolition activities. Prior to demolition work, the light tubes must be removed and disposed of following the requirements of *R.R.O. 1990, Regulation 347 General - Waste Management,* as amended (R.R.O. 1990, Reg. 347) under the EPA.

3.4 SILICA

3.4.1 Methodology

An assessment for the presence of silica was conducted. The presence of silica in building materials such as concrete, masonry, stone, terrazzo, refractory brick, ceramic tile, ceiling tile etc. was noted.

3.4.2 Findings

Silica is expected to be present in concrete observed.

3.4.3 Recommendations

The Guideline: *Silica on Construction Projects* issued by the MOL, dated April 20111 outlines: legal requirements, health effects, controlling the silica hazard, classification on work and measures, and

procedures for working with silica and should be followed during disturbance of silica-containing materials.

The Guideline defines the classification of work. It is the classification of the work that determines the appropriate respirators, measures and procedures that should be followed to protect the worker from silica exposure. In the guideline, silica-containing construction operations are classified into three groups, Type 1, Type 2, and Type 3 operations, and can be thought of as being of low, medium, and high risk. From Type 1 to Type 3 operations, the corresponding respirator, and measures and procedures become increasingly stringent.

Precautions should be taken as required during renovation projects impacting materials expected to contain silica (i.e., coring through concrete slabs, demolition of masonry or concrete units, ceramic tiles, brick, etc.) where dust may be generated. Whenever practical changing how a process is preformed to lower the silica exposure is preferable. Wet methods reduce dust and should be used whenever practical, particularly in cutting, grinding, and drilling operations.

Silica is included in O. Reg. 490/09 and the regulation provides information on the application of the regulation as well as allowable exposure levels, where the maximum TWA for respirable airborne silica (cristobalite) dust is 0.05 mg/m^3 and 0.01 mg/m^3 for quartz/Tripoli. However, the more stringent level of 0.025 mg/m^3 for respirable crystalline silica (quartz, cristobalite) applies as noted in the ACGIH 2018 TLVs for Chemical Substances and Physical Agents. The assessment and control program and medical surveillance requirements are for non-construction projects as defined in O. Reg. 490/09.

3.5 POLYCHLORINATED BIPHENYLS

3.5.1 Methodology

A visual review for the presence of PCBs in electrical equipment was completed. Equipment that is generally suspected of containing PCBs includes lamp ballasts, transformers, hydraulic systems, compressors, switchgear, and capacitors.

Due to height restrictions and the risk of electrical shock in handling operational light fixtures, the ballasts present in the fixtures observed, were not inspected for PCB labels or other PCB identifiers. Conclusions and recommendations regarding the presence of PCBs are based on limited observations and information provided regarding lighting renovations and is presented to provide guidance regarding the likelihood that PCB-containing equipment is or is not present. The exact extent and/or number of fluorescent lamp ballasts containing PCBs, if any, will not be commented on.

3.5.2 Findings

PCBs may be present in the fluorescent light ballasts of the four light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons.

Polychlorinated Biphenyls may also be present in plastics, applied dried paints, coatings or sealants, caulking, adhesives, paper or insulation. These are not expected to be of concern during the demolition.

3.5.3 Recommendations

When decommissioned, verify the PCB content of fluorescent lamp ballasts as per the Environment Canada publication *Identification of Lamp Ballasts Containing PCBs*, 1991. Handle, store and dispose of PCB-containing ballasts in accordance with *Federal Regulation SOR/2008-273*, under *Canadian Environmental Protection Act* (CEPA)

Should a material suspected to contain PCBs become uncovered during demolition activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present. Confirmed PCBs should be handled in accordance with *Federal Regulation SOR/2008-273*.

3.6 OZONE DEPLETING SUBSTANCES

3.6.1 Methodology

An assessment for equipment likely to contain ODSs was completed. Information on the type of equipment, manufacturer and type and quantity of refrigerants was recorded, where available.

3.6.2 Findings

Suspect building related cooling and refrigeration equipment suspected to be ODS-containing was not observed.

3.6.3 Recommendations

As evidence of suspect ODS-containing equipment was not observed, no recommendations have been provided.

3.7 MOULD

3.7.1 Methodology

An assessment for the potential presence of suspected visible mould and/or suitable conditions for mould growth (e.g., moist and/or water-stained building materials) was completed. This involved a visual assessment of accessible surfaces for obvious evidence of mould, moisture or water damage.

The conclusions made in this report provide description(s) of the potential source(s) of moisture that may have led to suitable conditions for mould growth, only in those cases where potential source(s) of moisture were identified. The visual assessment did not include an intrusive assessment. These conclusions will not necessarily identify all sources of moisture leading to suitable conditions for mould growth within the impacted area(s). This assessment does not constitute a building envelope/building systems assessment, which would include an intrusive investigation to assess the internal condition, potential moisture sources, and expected remaining service life of the various components and systems comprising the envelope of a building.

3.7.2 Findings

Suspect mould was not observed at the time of the assessment.

3.7.3 Recommendations

As evidence of mould was not observed at the time of the assessment no recommendations have been provided.

3.8 UREA FORMALDEHYDE FOAM INSULATION

3.8.1 Methodology

An assessment for the potential presence of UFFI was completed. This involved the assessment of exterior and interior walls for evidence of repaired openings (i.e., nozzle holes) made to facilitate the installation of the insulation. Wherever possible, an assessment of wall cavities through existing openings was made.

3.8.2 Findings

Evidence of the application of UFFI was not observed to be present.

3.8.3 Recommendations

As evidence of the application of UFFI was not observed, no recommendations have been provided.

3.9 RADIOACTIVE SOURCES

3.9.1 Methodology

An assessment for the presence of radioactive sources within smoke detectors was completed.

3.9.2 Findings

No smoke detectors were observed at the time of the assessment.

3.9.3 Recommendations

As evidence of radioactive sources was not observed, no recommendations have been provided.

3.10 OTHER DESIGNATED SUBSTANCES: ACRYLONITRILE, BENZENE, COKE OVEN EMISSIONS, ETHYLENE OXIDES, ISOCYANATE, VINYL CHLORIDE

3.10.1 Methodology

Designated substances including acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxides, isocyanates, and vinyl chloride are not typically a concern in building materials as they are bound in

manufactured products, and therefore these substances were not investigated. However, some common sources are shown below.

- Acrylonitrile may be present in stable form in paints and adhesives.
- Arsenic or arsenic compounds may be present in paints and adhesives.
- Benzene as a constituent of hydrocarbon-based mixtures and is present in a stable form in roofing materials, paints, and adhesives. Benzene in these forms is not expected to be of a worker exposure concern.
- Uncured Isocyanate may be present in paint finishes, varnishes, polyurethane plastics, synthetic rubbers, foams and adhesives.
- Vinyl chloride (monomer) is generally likely to be present in stable form within the PVC piping and conduits, where applicable.

3.10.2 Findings

Designated substances including acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxides, isocyanates, and vinyl chloride are not expected to be a concern in building materials,

3.10.3 Recommendations

No recommendations are required.

3.11 CHEMICAL, FUEL OIL AND/OR WASTE OIL STORAGE

3.11.1 Methodology

A visual assessment for chemical storage, fuel, oil and/or waste oil storage was conducted.

3.11.2 Findings

No evidence of underground storage tanks, significant chemical storage, or dumping was observed in the building assessed.

3.11.3 Recommendations

As no evidence of underground storage tanks, significant chemical storage, or dumping was observed, no recommendations are required.

3.12 ARSENIC

3.12.1 Methodology

A visual assessment for treated lumber that may contain arsenic was conducted.

3.12.2 Findings

Treated lumber applications associated with the building assessed were not observed.

3.12.3 Recommendations

As no evidence of lumber applications were observed. No recommendations are required.

3.13 CREOSOTE

3.13.1 Methodology

A visual assessment for lumber applications that may containing creosote was conducted.

3.13.2 Findings

Treated lumber applications associated with the buildings assessed were not observed.

3.13.3 Recommendations

As no evidence of lumber applications were observed. No recommendations are required.

4.0 Project-Specific Limitations

The assessment was limited the north storage shed and north storage bin. The remaining buildings were not assessed as they were previously assessed by DST in the report titled *Project-Specific Designated Substances Survey, Search and Rescue Station, Port Weller, Ontario,* and dated February 21, 2018.

5.0 Closure

This report has been prepared for the sole benefit of the Public Works and Government Services Canada and Fisheries and Oceans Canada. The report may not be used by any other person or entity without the express written consent of Stantec Consulting Ltd. and Public Works and Government Services Canada and Fisheries and Oceans Canada.

Any use which a third party makes of this report, or any reliance on decisions based on it, is the responsibility of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The information and conclusions contained in this report are based upon work undertaken by trained professionals and technical staff in accordance with generally accepted engineering and scientific

practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice.

The conclusions presented in this report represent the best technical judgment of Stantec Consulting Ltd. based on the data obtained from the work.

The conclusions are based on the site conditions encountered by Stantec Consulting Ltd. at the time the work was performed at the specific assessment and/or sampling locations and can only be extrapolated to an undefined limited area around these locations. The extent of the limited area depends on building construction and conditions, weather, building usage and other factors. Due to the nature of the investigation and the limited data available, Stantec Consulting Ltd. cannot warrant against undiscovered environmental liabilities.

If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

We trust that the above is satisfactory for your purposes at this time. Should you have any questions or concerns, or require additional information, please do not hesitate to contact the Stantec Project Manager at your convenience.

This report was prepared by Michael Shortt and reviewed by Linda Fleet and Martin Ling.

Regards,

STANTEC CONSULTING LTD.

2018.07.13
14:07:47 -04'00'

Linda Fleet
Project Manager
Phone: (905) 415-6368
linda.fleet@stantec.com

Digitally signed by Martin Ling
Date: 2018.07.13 13:35:29 -04'00'

Martin Ling
Senior Reviewer
Phone: (905) 415-6386
martin.ling@stantec.com

Rob Robinson
2018.07.13
13:58:43 -04'00'

Rob Robinson, P.Eng.
Principal
Phone: (519) 780-8196
rob.robinson@stantec.com

MS/LF/ML/jt

\\Cd1215-f01\work_group\01221\active\122150683\31 - Reports\DSS Report\Final\122150683_rpt_ms_2018July13_PSPC_PortWeller PSPC_final.docx

APPENDIX A
DESIGNATED SUBSTANCES AND HAZARDOUS BUILDING MATERIALS BACKGROUND INFORMATION AND REGULATORY FRAMEWORK

A.1 DESIGNATED SUBSTANCES

Asbestos

Asbestos is typically found in plaster, mechanical insulation, gaskets, thermal insulation on pipes, refractory material, roofing felts, floor tiles, ceiling tiles and parging, heat resistant panels, incandescent light fixture reflector plates, and any other material requiring a high degree of durability or thermal resistance. The common use of potential (breakable by hand) asbestos-containing materials (ACMs) in construction ceased voluntarily in the mid-1970s; however, the spray application of asbestos-containing fireproofing was not prohibited until 1986.

Asbestos-containing materials are grouped into two classifications, friable and non-friable materials. Friable ACMs are those that can easily be crumbled or broken apart by mere hand pressure. When these materials break apart asbestos fibres are then released into the atmosphere. Non-friable ACMs or "manufactured products" are materials that by the nature of their manufacturing/construction do not readily allow the release of asbestos fibres. These materials should not be cut or shaped with power tools, since this procedure may allow for the release of the asbestos fibres. Some materials or "manufactured products", such as plaster, drywall and ceiling tiles that are considered to be non-friable in an undisturbed state can become friable when damaged or disturbed. These are often referred to as "potentially" friable materials.

On Federal sites, asbestos requirements in the Canada Labour Code and Canada Occupational Health and Safety Regulations will apply.

Canada Labour Code (Part II) defines the requirements for an asbestos exposure control plan to be developed before undertaking any work activities that involves asbestos-containing materials. The Canada Labour Code *(Part II)* also stipulate the requirements for air monitoring during removal procedures.

Ontario Regulation 490/09 Designated Substances (O. Reg. 490/09), as amended, under the Ontario Occupational Health and Safety Act (OHSA) primarily regulates worker exposure to asbestos during manufacturing of asbestos-containing products, but also includes requirements related to respiratory equipment, measurement of airborne fibres, and medical surveillance of exposed workers.

Ontario Regulation R.R.O 1990, Regulation 833, Control of Exposure to Biological or Chemical Agents, as amended (R.R.O. 1990, Reg. 833) made under the OHSA, sets the same time weighted average limit (TWA) value based on 8-hour work days.

Ontario Regulation 278/05 Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations (O. Reg. 278/05), as amended, made under the OHSA defines an ACM as a material that contains 0.5% per cent or more asbestos by dry weight. Ontario Regulation 278/05 requires that an Asbestos Management Program (AMP) be implemented in buildings that have been identified to contain asbestos.

The general waste management regulation for the province of Ontario *R.R.O. 1990, Regulation 347 General - Waste Management,* as amended (R.R.O. 1990, Reg. 347) sets out the requirements for the proper disposal of asbestos waste in Ontario. The waste must be placed in a double sealed container, properly labelled, free of cuts, tears or punctures and disposed of at a licensed waste station which has been properly notified of the shipment(s) of asbestos waste. Asbestos waste must be hauled in a vehicle operating under a Certificate of Approval (CofA) from the Ontario Ministry of the Environment and Climate Change (MOECC). The vehicle must have a trained operator as well as an asbestos spill kit. The asbestos waste must be immediately buried at the licensed landfill operation operating under a CofA from the MOECC.

The transport of asbestos waste to the disposal site is covered by the federal *Transportation of Dangerous Goods Act.* Asbestos waste is to be transported in a proper vehicle with appropriate placards and transportation numbering.

Lead

Lead may be used in its pure metallic form or combined chemically with other elements to form lead compounds. Metallic lead is used to make products such as electric storage batteries, ammunition, lead solder, radiation shields, pipes, and sheaths for electric cables. Metallic lead is sometimes combined with other metals such as copper, tin and antimony as lead alloys for use in the manufacture of a variety of metal products.

Organic lead compounds contain a lead atom covalently bonded to carbon. Common examples of organic lead compounds include lead “soaps” such as lead oleates, high pressure lubricants, and anti-knock agents in gasoline.

Inorganic lead compounds (or lead salts) result when lead is combined with an element other than carbon. Examples are lead oxide, lead chromate, lead carbonate and lead nitrate. Inorganic lead compounds may occur as solids or in solutions, and are used in insecticides, pigments, paints, frits, glasses, plastics, and rubber compounds.

Lead may affect the health of workers if it is in a form that may be inhaled, ingested or absorbed through the skin. Lead dust consists of small, solid particles of metallic lead or lead compounds that are generated by sanding, grinding, polishing, and sawing operations. Lead fume is produced in significant amounts when solid lead or materials containing lead are heated to temperatures above 500^{o} C, as in welding and flame cutting or burning.

The United States Department of Housing and Urban Development (HUD) set a criteria of lead-based paint as 0.5% lead (by weight) or 5,000 parts per million (ppm) for evaluating whether lead is a hazard in a residential setting.

In Canada, the *Surface Coating Materials Regulations* (SOR/2005-109) under the *Canada Consumer Product Safety Act* provides a concentration of lead that must not be exceeded in surface coatings that

are presently sold in this country. This value has recently been reduced from 600 ppm to 90 ppm. However, it is important to note that there is not a direct correlation between the concentration of lead in a material to the potential occupational exposure if the material is disturbed.

O. Reg. 490/09 (which does not apply to construction projects) and R.R.O. 1990 Reg. 833, an occupational exposure limit (OEL) for airborne lead dust or fumes has been set at the TWA value of 0.05 milligram per cubic metre of air (mg/m^3) for workers. The TWA represents the time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects.

The EACO document entitled *Lead Guideline for Construction, Renovation* Maintenance or Repair, issued October 2014 sets out guidelines for operations involving the handling, application, removal, disturbance of clean-up of lead-containing materials. The guideline is intended for the environmental abatement industry, construction industry and painting industry in general and is based on industry standard best-practices for lead abatement and dust control measures.

The Ontario Ministry of Labour (MOL) document entitled *Guideline: Lead on Construction Projects,* issued by the MOL in April 2011, states that the removal of lead paint is not required unless work on these materials are likely to produce airborne lead dust or fumes, for example during welding, torch cutting, sanding and sand blasting. If these operations are likely to occur during building renovations or demolition, it is recommended that the removal of lead paint be carried out in accordance with procedures outlined in the proposed regulation.

Although the TWA and some other requirements under O. Reg. 490/09 and R.R.O. 1990 Reg. 833 do not apply to construction projects, procedures that provide the equivalent level of protection should be implemented on such projects where exposure to lead is possible.

Mercury

Mercury is commonly found in buildings, as it is contained in mercury vapour lighting, thermostats, thermometers, and electrical mercury switches. If mercury is exposed to the air, odourless vapours are formed. The regulated occupational exposure limit for airborne mercury is 0.025 mg/ m^3 (8-hour TWA) as prescribed in (O. Reg. 490/09) and R.R.O. 1990 Reg. 833.

In Canada, the *Surface Coating Materials Regulations* (SOR/2005-109) under the Federal Hazardous Products Act provides a concentration of mercury that must not be exceeded in surface coatings that are presently sold in this country. This value was set at 10 ppm in 2005. However, it is important to note that there is not a direct correlation between the concentration of mercury in a material to the potential occupational exposure if the material is disturbed.

Mercury is hazardous if it is inhaled or absorbed through the skin, therefore exposure controls (including both respiratory protection and skin protection) are important to consider.

Mercury disposal should be through a scrap dealer (elemental mercury), recycling firm for mercury vapour and returned to the manufacturer for light tubes and fixtures.

Mercury is included in O. Reg. 490/09 and applies to every employer and worker at a workplace where mercury is present, produced, processed, used, handled, or stored and at which the worker is likely to inhale, ingest, or absorb mercury (the maximum TWA for airborne mercury is 0.025 mg/ m^3). Requirements related to exposure to mercury are detailed, including those relating to worker safety and the use of personal protective equipment.

Ontario's Waste Management (R.R.O. 1990, Reg. 347) under the *Environmental Protection Act* (EPA) provides directives for the disposal of hazardous materials such as mercury.

Silica

Silica, also referred to as free crystalline silica, is found in concrete, cement, mortar, ceramic wall and floor tiles, stucco finishes and acoustic ceiling tiles. Prolonged exposure to, and inhalation of free crystalline silica, may result in respiratory disease known as silicosis, which is characterized by progressive fibrosis of the inner lung tissue and marked shortness of breath or impaired lung function. The maximum TWA for airborne Silica dust is 0.05 mg/ m^3 (O. Reg. 490/09 and R.R.O. 1990, Reg. 833).

Silica is included in O. Reg. 490/09 and the regulation provides information on the application of the regulation as well as allowable exposure levels, where the maximum TWA for airborne Silica dust is 0.05 mg/ m^3. The assessment and control program and medical surveillance requirements are for non-construction projects as defined in O. Reg. 490/09. Refer to the document entitled *Guideline: Silica on Construction Projects,* issued by the MOL in April 2011 for safe silica work practices and personal protective equipment (PPE).

Acrylonitrile

Acrylonitrile is a clear liquid that may be colourless or yellow and that readily reacts with other chemicals to produce long, chain-like molecules (polymers). Acrylonitrile-based polymers are used to produce nitrile rubbers, plastics, acrylic fibres, coatings and adhesives. Workers are typically exposed to acrylonitrile at manufacturing facilities that produce the aforementioned products through inhaling its vapour, direct skin contact, or through ingestion. Although acrylonitrile may be present in some of the building materials, including adhesives and coatings, the chemical will likely be bonded in the polymer form. Therefore, it is not expected that an adverse exposure to acrylonitrile will occur unless the building materials are heated to extreme temperatures. Acrylonitrile vapours may become released from the acrylonitrile-based polymers during a process where high temperatures are applied.

The TWA for a worker with respect to Acrylonitrile is 2 ppm as prescribed in O. Reg. 490/09 and R.R.O. 1990 Reg. 833. The Short term Exposure Limit (STEL) for Acrylonitrile is 10 ppm for any 15-minute exposure period.

Arsenic

The presence of arsenic in the paint coating on interior and exterior finishes is possible. As the painted surfaces will be handled as per the proposed lead regulation, it is not expected that arsenic concentrations in the air will exceed the TWA for a worker to arsenic (10 µg/m^3) as prescribed by O. Reg. 490/09 and R.R.O. 1990, Reg. 833. The STEL for arsenic is 50 µg/m^3 for any 15-minute exposure period.

Benzene

Historically, benzene has been produced as a by-product of coal gasification and metallurgical coke production in steel making. The light oil product from such processes contains benzene, toluene, ethyl benzene and xylene, and these components are separated by distillation. Today, most benzene is produced from the refining of petroleum.

Benzene has applications as a solvent in synthetic rubber manufacturing and processing, and in paints, varnishes, stains, adhesives, roofing materials and sealants. The use of benzene in tire and other rubber goods manufacturing and as a solvent and component of paints and adhesives has declined considerably as a result of concerns about workplace exposure. Nevertheless, it is often present in trace quantities in petroleum and aromatic solvents, some of which have replaced benzene in many uses. Benzene is also a minor component of gasoline mixtures sold in Canada.

The TWA for a worker to benzene is 0.5 ppm as prescribed by O. Reg. 490/09 and R.R.O. 1990, Reg. 833. It is possible that benzene was present in the paints, adhesives and roofing materials used during the original construction of many buildings. However, over time, the benzene component typically volatilizes out of the paints, solvents and roofing bitumens and is released into the ambient air. Therefore, it is likely that only trace levels of benzene presently exist in these building materials. It is not expected that benzene emissions from any existing building materials on site will exceed the allowable TWA. The STEL for benzene is 2.5 ppm for any 15-minute exposure period.

Coke Oven Emissions

Coke oven emissions are found in the exhaust from the burning process of coke, and are typically not a concern in buildings. The TWA for a worker with respect to coke oven emissions is 150 µg/m^3 as prescribed by O. Reg. 490/09 and R.R.O. 1990, Reg. 833.

Ethylene Oxides

Ethylene oxide is a common by product of fumigation or sterilization procedures.

The TWA for a worker with respect to ethylene oxides is 1 ppm as prescribed in O. Reg. 490/09 and R.R.O. 1990, Reg. 833. The STEL for ethylene oxides is 10 ppm for any 15-minute exposure period.

Isocyanates

Isocyanates are a class of chemicals used in the manufacture of certain types of plastics, foams and roof insulation. The isocyanate (-CNO) group reacts very readily with certain other types of molecules, a property responsible for the usefulness of isocyanates in industry. Due to the high reactivity of the isocyanate group, exposure to isocyanates can result in primary irritation, sensitization and hypersensitivity reactions. The respiratory system, the eyes and the skin are the main areas affected by exposure. Isocyanates in their initial form are found as a vapour, a mist, or a dust which become airborne and then taken into the body. Once the isocyanates are chemically bonded to other chemicals during manufacturing processes, the isocyanates are not readily available to become airborne unless heated. Therefore, isocyanate exposure is not expected to be a concern as long as the burning of plastics, foams, and insulation is not carried out.

The TWA for a worker with respect to isocyanates, organic compounds is 5 parts per billion (ppb) as prescribed in O. Reg. 490/09 and R.R.O. 1990, Reg. 833. The STEL for isocyanates, organic compounds is 20 ppb for any 15-minute exposure period.

Vinyl Chloride

Vinyl chloride is found in many applications in building such as plumbing pipes, protective coatings on insulated pipes and interior finishes (i.e., vinyl baseboard trim). Vinyl chlorides in the above materials are bound in a solid matrix and are unlikely to become airborne such that it would exceed the maximum allowable TWA of 1 ppm, as prescribed in O. Reg. 490/09 and R.R.O. 1990, Reg. 833.

A.2 HAZARDOUS BUILDING MATERIALS

Polychlorinated Biphenyls (PCBs)

The use of PCBs in electrical equipment such as transformers and capacitors, including capacitors found in fluorescent lamp ballasts, was common up to 1980. R.R.O 1990 Regulation 362 Waste Management – PCB's (R.R.O. 1990, Reg. 362) under the EPA, prohibits the use of PCBs in electrical equipment installed after July 1, 1980.

The TWA for a worker with respect to PCBs is 0.05 mg/ m^3as prescribed in R.R.O. 1990, Reg. 833.

As of September 5, 2008, under Subsection 93(1) of the *Canadian Environmental Protection Act,* (CEPA), Federal PCB regulations have been published by the Canada Gazette Part II (SOR/2008-273) that impose specific deadlines for the elimination of all PCBs in concentrations at or above 50 milligrams/kilogram (mg/kg). The regulation requires the elimination of all PCBs and PCB-containing materials currently in-use and in storage and limits the period of time PCB materials can be stored before being eliminated. Other aspects of the regulation govern the labelling and reporting of stored PCB materials and equipment as well as improved practices for the management of PCBs that remain in use (i.e., those with PCB concentrations less than 50 mg/kg) until their eventual elimination.

Ozone-Depleting Substances

Ozone-depleting substances (ODSs) are chemical agents known as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) used in various refrigeration equipment including air-conditioning, heat pump, refrigeration or freezer units. They have also been used in solvents, as aerosol additives in the production of foam insulation and in fire extinguishing equipment. The use of refrigerants (including those that are ODSs or contain ODSs) is regulated by Ontario Regulation 463/10, *Ozone Depleting Substances and Other Halocarbons* (O. Reg. 463/10), under the EPA. The regulation imposes restrictions on the purchasing of refrigerants and on the servicing, dismantling, disposing of or decommissioning of equipment containing refrigerants or halon fire extinguishing agents.

On federal land, aboriginal land and federal works, buildings and undertakings, *Federal Halocarbon Regulation 2003* (SOR/2003-289) applies. All other buildings and uses of refrigerants and other agents are under the *Ozone-Depleting Substances Regulations 1998* (SOR/99-7), under CEPA. The regulations prohibit the release of halocarbons contained in refrigeration systems, air conditioning systems, fire extinguishers (except to fight a fire that is not a fire caused for training purposes) or containers or equipment used in the re-use, recycling, reclamation or storage of a halocarbon.

The regulations also imposes restrictions on the servicing and dismantling, disposing of or decommissioning of any system containing halocarbons and requires the recovery of halocarbons into an appropriate container by a certified individual. The regulation also details an owner's record-keeping obligations.

Mould

Mould can be found everywhere in the outside environment, on plants, in soil and on dead and decaying matter (i.e., dead leaves). Mould requires two main conditions in order to grow - a source of food (a substrate typically comprised of cellulose) and water. Sources of food for mould are plentiful in outdoor and indoor environments; however it is the presence of water in an indoor environment that will determine mould growth. The source of water can be a result of a water pipe leak or even excess condensation. Thus, the key to controlling mould indoors is to control the presence of water.

At present, there are no specific laws or regulations governing acceptable levels of mould in buildings. The lack of specific regulatory standards is due in part to an inability to establish exposure-response relationships. Variation in individual susceptibility, limitations in sampling and analytical techniques, and the vast number of fungal agents and their products make it difficult to establish safe levels of exposure for all individuals. With a lack of defined exposure criteria, current Health Canada and other agency guidelines on the assessment and control of mould contamination in public buildings are largely based on prudent avoidance (i.e., remove any indoor growth or amplification site of mould, regardless of the concentration of moulds or their products in the indoor environment).

Although there are currently no regulations in Canada pertaining specifically to mould in buildings, based on an Ontario MOL alert, employers are required by Section 25(2)(h) of the Occupational Health and Safety Act to take every precaution reasonable in the circumstances for the protection of workers.

The OHSA places a responsibility on constructors (Section 23), employers (Section 25), and supervisors (Section 27) to ensure the health and safety of workers. This includes protecting workers from mould in workplace buildings. Various sections of the Industrial, Construction, Mining or Health Care regulations may also apply to maintenance and remediation activities.

The Ontario MOL has published an Alert (MOL, 2000) indicating that sustained and/or extensive growth of visible mould on interior surfaces of a building is unacceptable and stating that mould growth on the interior surfaces of buildings is a risk factor for health problems.

Several guidelines and other resources describe procedures for the investigation and remediation of mould. The following documents indicate that mould observed in occupied building should be remediated in accordance with these procedures:

- *Environmental Abatement Council of Ontario's (EACO) Mould Abatement Guidelines,* 2010 – Edition 2;
- *Mould Guidelines for The Canadian Construction Industry,* Canadian Construction Association – 82, 2004;
- *Guidelines on Assessment and Remediation of Fungi in Indoor Environment,* New York City Department of Health and Mental Hygiene, November 2008;
- *Bioaerosols: Assessment and Control,* American Conference of Governmental Industrial Hygienists (ACGIH), 1999;
- *Fungal Contamination in Public Buildings: Health Effects and Investigation Methods,* Federal-Provincial Committee on Environmental and Occupational Health, 2004;
- *Field Guide for the Determination of Biological Contaminants in Environmental Samples,* American Industrial Hygiene Association (AIHA), 1996; and,
- *Clean-Up Procedures for Mould in Houses,* Canada Mortgage and Housing Corporation (CMHC), 2004.

Urea Formaldehyde Foam Insulation

Urea-formaldehyde foam insulation (UFFI) was developed in Europe in the 1950s as an improved means of insulating difficult-to-reach cavities in building walls. It is typically made at a construction site from a mixture of urea-formaldehyde resin, a foaming agent and compressed air. When the mixture is injected into the wall, urea and formaldehyde unite and "cure" into an insulating foam plastic.

During the 1970s, when concerns about energy efficiency led to efforts to improve home insulation in Canada, UFFI became an important insulation product for existing houses. Most installations occurred between 1977 and its ban in Canada in 1980.

In the insulating process, a slight excess of formaldehyde was often added to ensure complete "curing" with the urea to produce the urea-formaldehyde foam. Formaldehyde is a pungent, colourless gas commonly used in water solution as a preservative and disinfectant. It is also a basis for major plastics, including durable adhesives. It occurs naturally in the human body and in the outdoor environment. Formaldehyde is used to bond plywood, particleboard, carpets and fabrics. Formaldehyde is also a by-product of combustion; it is found in tobacco smoke, vehicle exhaust and the fumes from furnaces, fireplaces and wood stoves.

While small amounts of formaldehyde are harmless, it is an irritating and toxic gas in significant concentrations. Symptoms of overexposure to formaldehyde include irritation to eyes, nose and throat; persistent cough and respiratory distress; skin irritation; nausea; headache; and dizziness.

Health Canada has determined that 0.1 parts per million (ppm) is a safe level of formaldehyde in the home. Sensitivity to this level may vary based on individual age and health.

Tests show that UFFI is not a source of over-exposure to formaldehyde after the initial curing and release of excess gas. As it was last installed in 1980, it would certainly not be causing excess indoor formaldehyde today. Buildings with UFFI show no higher formaldehyde levels than those without it. However, if UFFI comes in contact with water or moisture, it could begin to break down. Wet or deteriorating UFFI should be removed by a specialist and the source of the moisture problem should be repaired.

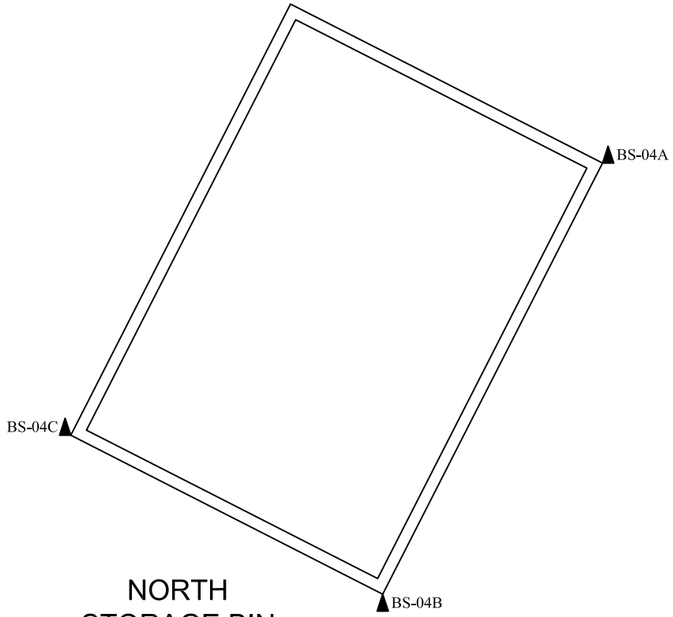
There are currently no regulations in Canada pertaining specifically to UFFI in buildings. However, the Occupational Health and Safety Act places a responsibility on constructors (Section 23), employers (Section 25), and supervisors (Section 27) to ensure the health and safety of workers.

APPENDIX B
SITE PHOTOGRAPHS

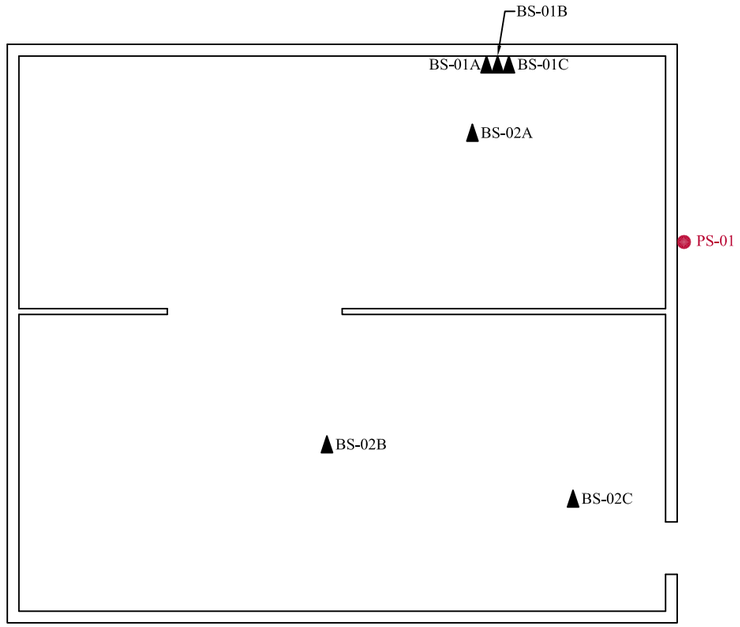
LOCATION	DESCRIPTION	PHOTOGRAPHS
North Storage Shed	• General view of North Storage Shed • Non-asbestos containing roofing materials-shingles • Sample BS-03A	
North Storage Shed	• Non-asbestos-containing Interior door caulking – grey • Samples BS-01A-C	
North Storage Shed	• General view of North Storage Shed • Non-asbestos-containing vinyl sheet flooring -grey • Samples BS-02A-C	

LOCATION	DESCRIPTION	PHOTOGRAPHS
North Storage Bin	• General view of North Storage Bin	
North Storage Bin	• Non-asbestos-containing exterior caulking - grey • Samples BS-04A-C	

APPENDIX C
FLOOR PLANS



NORTH
STORAGE BIN



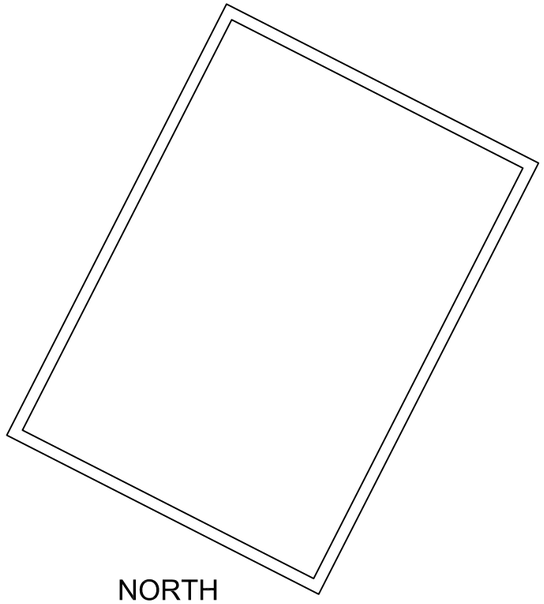
NORTH STORAGE SHED

LEGEND

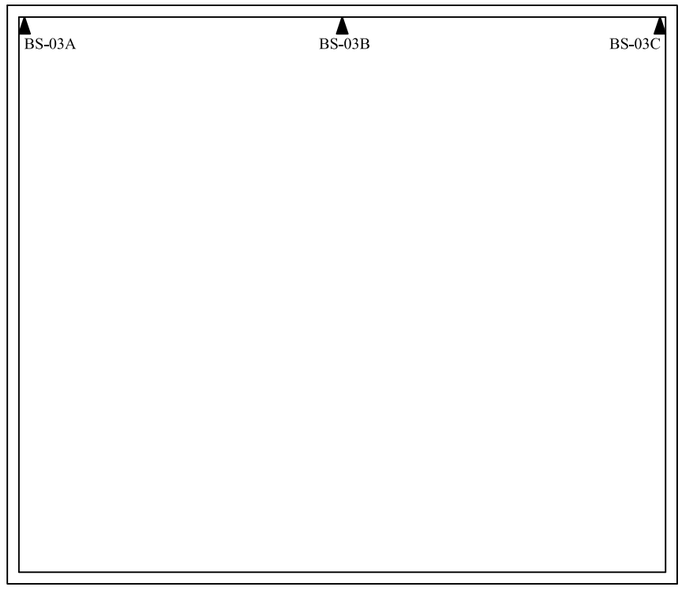
- BULK SAMPLE
- PAINT CHIP SAMPLE

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

Reference:	**Project No.:** 122150683.000	**Client:** PUBLIC WORKS AND GOVERNMENT SERVICES CANADA	FLOOR PLAN	**Dwg. No.:** 1
	Scale: N.T.S.			
	Date: 18/06/08	**Site Address** PORT WELLER SEARCH AND RESCUE STATION PORT WELLER, ONTARIO		
	Dwn. By: CD PK SL2018060091			
	App'd By: LF			



NORTH
STORAGE BIN - ROOF



NORTH STORAGE SHED - ROOF

LEGEND

▲ BULK SAMPLE

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

Reference:	**Project No.:** 122150683.000 **Scale:** N.T.S. **Date:** 18/06/08 **Dwn. By:** CD PK SL2018060092 **App'd By:** LF	**Client:** PUBLIC WORKS AND GOVERNMENT SERVICES CANADA **Site Address** PORT WELLER SEARCH AND RESCUE STATION PORT WELLER, ONTARIO	ROOF PLAN	**Dwg. No.:** 2	Stantec

APPENDIX D
LABORATORY ANALYTICAL REPORT – ASBESTOS: POLARIZED LIGHT MICROSCOPY

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 551806203
Customer ID: 55JACQ30J
Customer PO: 122150683
Project ID:

Attn: Michael Shortt
Stantec Consulting Ltd.
300-675 Cochrane Drive, West Tower
Markham, ON L3R 0B8

Phone: (905) 474-7700
Fax: (905) 479-9326
Collected: 5/29/2018
Received: 5/29/2018
Analyzed: 6/01/2018

Proj: 122150683 Port Weller

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: BS-01A ***Lab Sample ID:*** **551806203-0001**
Sample Description: North Storage Shed - Interior Door Caulking - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: BS-01B ***Lab Sample ID:*** **551806203-0002**
Sample Description: North Storage Shed - Interior Door Caulking - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: BS-01C ***Lab Sample ID:*** **551806203-0003**
Sample Description: North Storage Shed - Interior Door Caulking - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: BS-02A-Vinyl Sheet Flooring ***Lab Sample ID:*** **551806203-0004**
Sample Description: North Storage Shed - Vinyl Sheet Flooring - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Green	0.0%	100%	None Detected	

Client Sample ID: BS-02A-Fiber ***Lab Sample ID:*** **551806203-0004A**
Sample Description: North Storage Shed - Vinyl Sheet Flooring - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Yellow	0.0%	100%	None Detected	

Client Sample ID: BS-02B-Vinyl Sheet Flooring ***Lab Sample ID:*** **551806203-0005**
Sample Description: North Storage Shed - Vinyl Sheet Flooring - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Green	0.0%	100%	None Detected	

Client Sample ID: BS-02B-Fiber ***Lab Sample ID:*** **551806203-0005A**
Sample Description: North Storage Shed - Vinyl Sheet Flooring - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Yellow	0.0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 551806203
Customer ID: 55JACQ30J
Customer PO: 122150683
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: BS-02C-Vinyl Sheet Flooring ***Lab Sample ID:*** **551806203-0006**

Sample Description: North Storage Shed - Vinyl Sheet Flooring - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Green	0.0%	100%	None Detected	

Client Sample ID: BS-02C-Fiber ***Lab Sample ID:*** **551806203-0006A**

Sample Description: North Storage Shed - Vinyl Sheet Flooring - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Yellow	0.0%	100%	None Detected	

Client Sample ID: BS-03A ***Lab Sample ID:*** **551806203-0007**

Sample Description: North Storage Shed - Roofing Materials - Shingles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Black	0.0%	100%	None Detected	

Client Sample ID: BS-03B ***Lab Sample ID:*** **551806203-0008**

Sample Description: North Storage Shed - Roofing Materials - Shingles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Black	0.0%	100%	None Detected	

Client Sample ID: BS-03C ***Lab Sample ID:*** **551806203-0009**

Sample Description: North Storage Shed - Roofing Materials - Shingles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Black	0.0%	100%	None Detected	

Client Sample ID: BS-04A ***Lab Sample ID:*** **551806203-0010**

Sample Description: North Storage Bin - Exterior Caulking - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: BS-04B ***Lab Sample ID:*** **551806203-0011**

Sample Description: North Storage Bin - Exterior Caulking - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: BS-04C ***Lab Sample ID:*** **551806203-0012**

Sample Description: North Storage Bin - Exterior Caulking - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	6/01/2018	Gray	0.0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

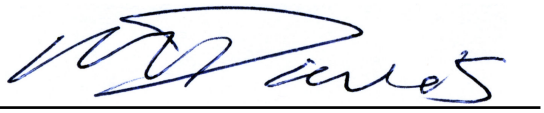
EMSL Canada Order 551806203
Customer ID: 55JACQ30J
Customer PO: 122150683
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s):

Anne Balayboa	PLM Grav. Reduction (5)
Natalie D'Amico	PLM Grav. Reduction (10)

Reviewed and approved by:



Matthew Davis or other approved signatory
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 06/01/201817:39:38

APPENDIX E
LABORATORY ANALYTICAL REPORT – LEAD: PAINT CHIP ANALYSIS

EMSL Canada Inc.
2756 Slough Street, Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com torontolab@emsl.com

EMSL Canada Or	551806216
CustomerID:	55JACQ30J
CustomerPO:	122150683
ProjectID:	

Attn: **Mike Shortt**
Stantec Consulting Ltd.
300-675 Cochrane Drive, West Tower
Markham, ON L3R 0B8

Phone:	(905) 474-7700
Fax:	(905) 479-9326
Received:	05/29/18 4:35 PM
Collected:	4/16/2018

Project: **122150683 Port Weller**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
PS-01	*551806216-0001*	4/16/2018	5/31/2018	0.2314 g	<86 ppm
	Site: North Storage Shed - White Coloured Paint				

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 06/01/2018 11:19:33

APPENDIX F
EVALUATION CRITERIA FOR ASSESSING ASBESTOS-CONTAINING MATERIALS

CRITERIA FOR ASSESSING ASBESTOS-CONTAINING MATERIALS

A description of the criteria used in evaluating the condition, accessibility and exposure risk of asbestos-containing materials is provided below. The criteria is based on the Public Services and Procurement Canada (PSPC) document entitled *Asbestos Management Standard* (June 5, 2017) and industry standards of practice.

F.1 ASSESSMENT OF CONDITION

F.1.1 Spray Applied Fireproofing, Insulation and Textured Finishes

In evaluating the condition of ACM spray applied as fireproofing, thermal insulation or texture, decorative or acoustic finishes, the following criteria apply:

Good

Surface of material shows no significant signs of damage, deterioration, or delamination. Up to one percent visible damage to surface is allowed within range of GOOD. Evaluation of sprayed fireproofing requires the Assessor to be familiar with the irregular surface texture typical of sprayed asbestos products. GOOD condition includes unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed, and encapsulated fireproofing or texture finishes where the encapsulation has been applied after the damage or fallout occurred.

Poor

Sprayed materials show signs of damage, delamination, or deterioration. More than one percent damage to surface of ACM spray.

In observation areas, where damage exists in isolated locations, both GOOD and POOR condition may be reported. The extent or percentage of each condition will be recorded on the Assessor's assessment form.

FAIR condition is not utilized or considered as a valid criterion in the evaluation of sprayed fireproofing, sprayed insulation, or texture coat finishes.

The evaluation of ACM spray applied as fireproofing, non-mechanical thermal insulation, or texture, decorative or acoustic finishes which are present above ceilings, may be limited by the number of observations made, and by building components such as ducts or full height walls that obstruct the above ceiling observations. Persons entering the ceiling area are advised to be watchful for ACM DEBRIS prior to accessing or working above ceilings in areas of building with ACM, regardless of the reported condition.

F.1.2 Other ACM

In evaluating the condition of mechanical insulation (on boilers, breaching, ductwork, piping, tanks, equipment etc.) the following criteria are used:

Good

Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where the jacketing has minor surface damage (i.e., scuffs or stains), but the jacketing is not penetrated.

Fair

Minor penetration damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that has never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges should be minor to none.

Poor

Original insulation jacket is missing, damaged, deteriorated or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.

The evaluation of mechanical insulation may be limited by the number of observations made and building components such as ducts or full height walls that obstruct observations. In these circumstances, it is not possible to observe each foot of mechanical insulation from all angles.

F.1.3 Non-Friable and Potentially Friable Materials

Non-friable materials generally have little potential to release airborne fibres, even when damaged by mechanical breakage. However, some non-friable materials, i.e., exterior asbestos cement products, may have deteriorated so that the binder no longer effectively contains the asbestos fibres. In such cases of significantly deteriorated non-friable material, the material will be treated as a friable product.

F.1.4 Asbestos-Containing Material Debris

F.1.5 Debris from Friable Asbestos-Containing Material

The presence of fallen friable asbestos-containing material is noted separately from the presumed friable asbestos-containing material source (sprayed fireproofing, thermal insulation, texture, decorative or acoustic finishes or mechanical insulation) and is referred to as debris.

The presence of fallen asbestos-containing material from damaged non-friable asbestos-containing material is reported separately from the non-friable asbestos-containing material source. Fallen non-friable asbestos-containing material that has become friable is reported as debris. Workers are advised to

be watchful for the presence of debris prior to accessing, or working in proximity to, mechanical insulation or above ceiling areas of buildings with asbestos-containing material, regardless of the reported presence or absence of debris.

PROJECT EFFECTS DETERMINATION FOR THE PORT WELLER SEARCH AND RESCUE STATION UPGRADE PROJECT

ARCADIS Design & Consultancy for natural and built assets

Public Works and Government Services Canada

PROJECT EFFECTS DETERMINATION FOR THE PORT WELLER SEARCH AND RESCUE STATION UPGRADE PROJECT: PORT WELLER COAST GUARD STATION DFRP# 86422

August 2018

Project Effects Determination for the Port Weller Search and Rescue Station Upgrade Project: Port Weller Coast Guard Station

DFRP# 86422

Frederick Bernard, M.A.
Senior Environmental Specialist

Marilena Di Giuseppe, M.A.Sc., EPt
Environmental Scientist

Prepared for:

Public Services and Procurement Canada

Prepared by:

Arcadis Canada Inc.
121 Granton Drive, Suite 12
Richmond Hill, ON
L4B 3N4

Tel 905.764.9380
Fax 905.764.9386

Our Ref:

351173-008

Date:

August 2018

CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

As part of a Regional Individual Standing Offer (RISO) under Stream 1 (provision of professional and technical services for various types of environmental services in the Ontario Region) to Public Services and Procurement Canada (PSPC), Arcadis Canada Inc. (Arcadis) was retained to conduct a Project Effects Determination (PED) for the proposed Port Weller Partial Demolition and Addition project in St. Catharines, Ontario. The scope of work (SOW) involved the following key components:

a) two site visits to Port Weller to become familiar with the site, investigate proposed construction areas, and to obtain details of the proposed project from on-site personnel;

b) a review of the site information provided by PSPC, and other information provided by Fisheries and Oceans Canada (DFO);

c) the collection of additional information, research, report preparation, etc., as required; and,

d) the preparation of the PED in accordance with the Fisheries and Oceans Template, as per Section 67 of the *Canadian Environmental Assessment Act 2012* (*CEAA* 2012), which states that federal authorities will ensure that projects on federal lands do not cause significant adverse environmental impacts.

2.0 GENERAL INFORMATION

1. Title: Port Weller Search and Rescue Station Upgrade Project, Port Weller Coast Guard Station, St. Catharines, Ontario	
2 Proponent: Department of Fisheries and Oceans Canada (DFO)	
3. Other Contacts (Proponent, Consultant, Contractor or another DFO Sector): Public Works and Government Services Canada (PSPC) Canadian Coast Guard Arcadis Canada Inc.	**4. Role of each contact:** PSPC – coordinate the completion of the PED Canadian Coast Guard – operates and maintains the station Arcadis Canada Inc. – consultant retained to conduct and complete the PED
5. Source (Contact) (DFO sector, company, organization, provincial or federal department):	
6. Received Date:	
7. PATH No.:	**8. DFO File No:** 9L555
9. Other relevant file numbers:	

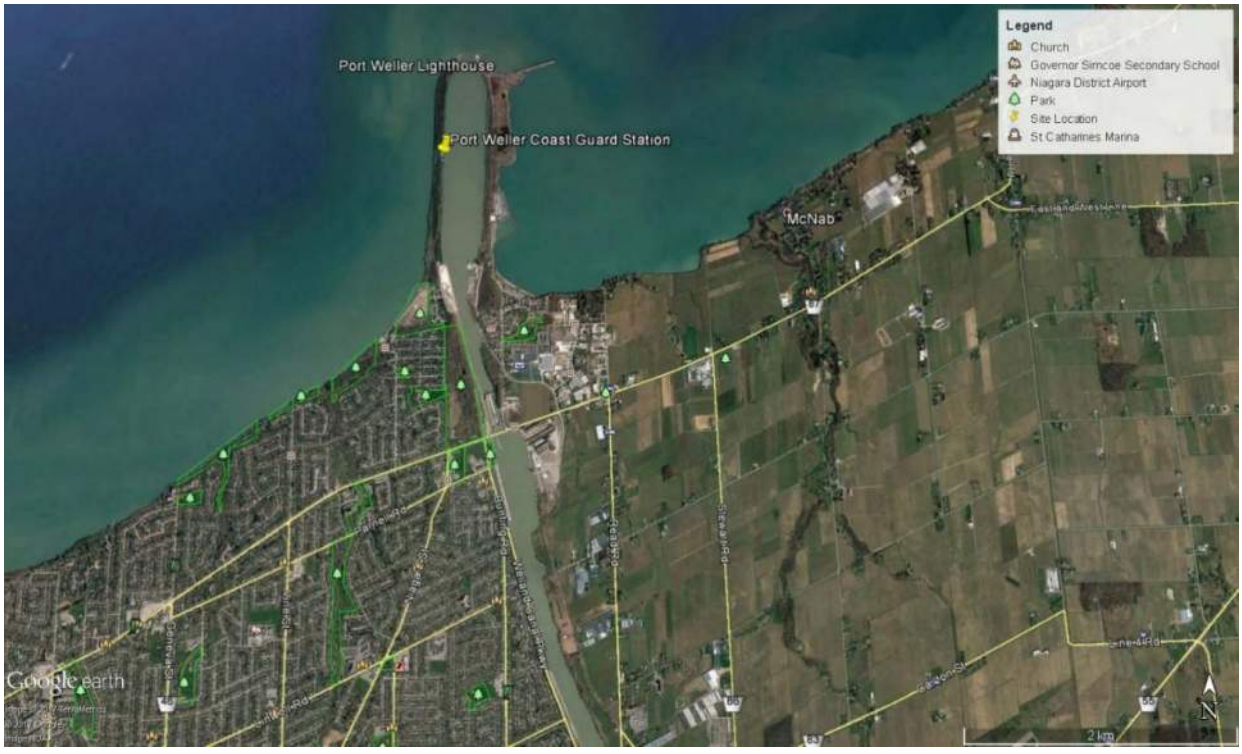
3.0 BACKGROUND

10. Background about Proposed Development (including a description of the proposed development):

The site is on a narrow peninsula, with the Welland Canal to the east and Lake Ontario to the West. The primary site functions are related to marine Search and Rescue Operations conducted by the Canadian Coast Guard (CCG). A site location map is provided below as Figure 3-1.

The main on-site structure comprises the following three components: the Federally Designated Historic Lighthouse Keeper's dwelling (constructed circa 1930), the 1950's addition which is referred to as the "Search and Rescue Office", and the "Breezeway" which is a connecting structure between the Historic dwelling and the Office. The proposed project involves the complete demolition of the Office and Breezeway while keeping the 1930's structure intact as well as constructing a new, single-storey Search and Rescue Office with an estimated footprint of 268 m^2 (2,000 ft^2). A new garage structure with an estimated footprint of 213 m^2 will be constructed while the existing septic bed will be decommissioned, to be replaced with a new septic bed and new septic line at a different location; and the existing water well will also be decommissioned, to be replaced with a new water well and new water line at a new location. Various ancillary structures will also be removed and there is the potential for relocation of various fuel storage tanks. A detailed project description is provided later in Chapter 4.

Figure 3-1 Location of Port Weller Coast Guard Station



3.1 Main On-Site Buildings

The main structure on the site comprises three components: the Federally Designated Historic Lighthouse Keeper's Dwelling (constructed circa 1930), the 1950's addition which is referred to as the Search and Rescue Office, and the "Breezeway" which is a connecting structure between the Historic dwelling and the Office (Taylor Hazell Architects Ltd., 2016; PSPC, 2017). Figure 3-2 shows the main on-site structure and adjacent dock for mooring of vessels used in search and rescue operations.

Lighthouse Keeper's Dwelling

As noted above, the former Lighthouse Keeper's Dwelling is a recognized federal heritage building. Built in 1931, it is a strongly constructed, single-storey concrete building with distinct Art Deco attributes such as a flat roofline and streamlined appearance. Notable features include the stylized, flattened detailing, a raised concrete entablature, symmetrically placed steel windows and central, solid oak doors (see Figure 3-3). The interior currently consists of a galley (kitchen area), living area, recreation area, and fitness area. The federal heritage designation is confined to the footprint of the building (Taylor Hazell Architects Ltd., 2016).

Office and Breezeway

The Search and Rescue Office is a one-storey, L- shaped, gable-roof building which was constructed in 1953 and is also identified on the Canadian Register of Historic Places (see Figure 3-4) (Parks Canada, 2018). The Search and Rescue Office is a recognized federal heritage building because of its historical associations, and its architectural and environmental values (Taylor Hazell Architects Ltd., 2016). The upper level currently consists of the Captain's office and living quarters, and one washroom. The basement (lower level) consists mainly of a storage room adjacent to laundry facilities and a main central storage space containing staff lockers and ready room. The "Breezeway", a connecting structure between the Historic dwelling and the Office, also serves as an additional storage space for tools and implements.

There is a developed soft landscape of lawns and plantings, that has changed over time (see Figure 3-5). It is not a designed landscape (Taylor Hazell Architects Ltd., 2016). Coast Guard staff participating in the site visits reported that all of the trees in the landscaped area were planted by Coast Guard staff within the last 17 to 20 years or so. There is a paved parking lot to the north of the subject buildings, which extends off of the Welland Canal Parkway.

Figure 3-2 Main On-Site Structure and Adjacent Dock

Figure 3-3 Former Lighthouse Keeper's Dwelling

Figure 3-4 Search and Rescue Office

Figure 3-5 Landscaped Area Around On-Site Buildings

3.2 Ancillary Structures

To the north of the Former Lighthouse Keeper's Dwelling are two additional structures known as the "Hoop House", used for repair of boats, and unheated storage of boats in the winter (see Figure 3-6), and the "Bread Box" (Storage Building) (see Figure 3-7). A smaller structure located to the northeast of these is known as the "Homer Trailer" (a wooden garden storage structure) and is used for storage of materials used for small on-site projects (see Figure 3-8). A small storage building known as the "Rope Locker" is situated to the immediate west of the Former Lighthouse Keeper's Dwelling (see Figure 3-9). This building is constructed of stick-framed wood, is situated on a concrete slab, and is used to store reels of rope, solvents, and oils. A small structure known as the "Engineer's Shack" (or Engineer's Office) is used for on-site tool storage, and is located to the immediate north of the 1930s dwelling (see Figure 3-10).

There is an Environment and Climate Change Canada (ECCC) Hydrometric Gauging Station located on the western edge of the subject site, overlooking Lake Ontario, as shown on Figure 3-11. The station is a prefabricated metal building that is locked at all times and according to Coast Guard staff is periodically entered by ECCC staff. The station is located in an area that is experiencing severe erosion, and could be vulnerable if this erosion continues and it is not moved away from the top of slope.

Figure 3-6 Hoop House

Figure 3-7 Bread Box (Storage Building)

Figure 3-8 Homer Trailer (Wooden Garden Storage Structure)

Figure 3-9 Rope Locker

Figure 3-10 Engineer's Shack (Engineer's Office)

Figure 3-11 Environment and Climate Change Canada Hydrometric Gauging Station

3.3 Fuel/Oil Storage

There are six outdoor above-ground fuel/oil storage tanks (ASTs) to the north and west of the main structure. These are:

- two single-wall tanks containing 1,110 L of heating oil located on concrete pads (One of the tanks is shown as Figure 3-12).
- one emergency diesel generator containing 620 L of diesel fuel (see Figure 3-13).
- one 1,900 L double-wall steel gasoline tank positioned on a concrete pad and surrounded by safety curbing, as shown in Figure 3-14. Currently, Coast Guard staff refuel the search and rescue Zodiac Boat by manually transporting gasoline from the gasoline storage tank using 20 L jerry cans to transport the fuel to the Zodiac docking location. Approximately ten (10) trips are required to and from the tank and the dock), to complete the refueling process;
- one single-wall diesel fuel tank with an 11,000 L capacity situated on a concrete pad near the existing “Engineer’s Shack” as shown on Figure 3-15. There is an existing underground diesel fuel line which transports the fuel from the storage tank to the dock for refueling of the “Cape Storm” search and rescue boat (see Figure 3-16); and
- one 500 L yellow double-wall steel waste oil tank adjacent to the gasoline tank (see Figure 3-14).

Figure 3-12 Heating Oil Tank

Figure 3-13 Emergency Diesel Generator

Figure 3-14 Gasoline and Waste Oil Storage Tanks

Figure 3-15 Diesel Storage Tank

Figure 3-16 Underground Diesel Fuel Line

4.0 PROJECT REVIEW

11. DFO's rationale for the project review:

Project is on federal land ☒ and;

☒ DFO is the proponent

☐ DFO to issue *Fisheries Act* Authorization, *Species at Risk Act* Permit or other regulatory permit

☐ DFO to provide financial assistance to another party to enable the project to proceed

☐ DFO to lease or sell federal land to enable the project to proceed

☐ Other

12. Fisheries Act Section(s) and/or Species at Risk Act Sections 73 or 74 (if applicable):

Not Applicable

13. Primary Authority: Fisheries and Oceans Canada (DFO)	**14. Primary Authority's rationale for involvement:** The site is owned by DFO.
15. Other Authorities involved in review: Canadian Coast Guard.	**16. Other Authority's rationale for involvement:** The site is occupied by Canadian Coast Guard.

17. Other Contacts and Responses:

None. DFO and Canadian Coast Guard provided the information required by Arcadis.

4.1 Scope of Project

18. Scope of Project (details of the project subject to review):

The proposed project involves the demolition and decommissioning of certain on-site structures and addition of some new structures as described below. Based on discussions with Coast Guard staff who participated in the site visits, it is our understanding that the entire proposed project will occur within the existing building footprint and the adjacent landscaped area.

As was noted in Chapter 3, presently, the main structure on the site comprises three components: the Federally Designated Historic Former Lighthouse Keeper's Dwelling (constructed circa 1931), the 1953 addition which is referred to as the "Search and Rescue Office", and the "Breezeway" which is a connecting structure between the Historic dwelling and the Office. The proposed project is to completely demolish the Office and Breezeway while keeping the 1930s structure intact as well as constructing a new, single-storey Search and Rescue Office, with an estimated footprint of 268 m^2 and a new garage structure with an estimated footprint of 213 m^2. The existing septic bed will be decommissioned, to be replaced with a new septic bed at a different location; and the existing water well will also be decommissioned, to be replaced with a new water well at a new location. New septic and water lines will also be installed. Additionally, various ancillary structures will be removed and there is the potential for relocation of various fuel storage tanks.

Figures 4-1 to 4-4 show the Construction Site Plan, New Living Quarters - New Work Roof Plan, New Living Quarters – New Work Plan, and New Work Plan for Lighthouse Keeper's Dwelling, as proposed plans were provided by PSPC.

Main On-Site Structures

Former Lighthouse Keeper's Dwelling

For the proposed project work, the exterior of the building will be preserved, while the interior will be demolished, upgraded, and remodelled, and will consist of two offices and a meeting area.

Search and Rescue Office and Breezeway

The existing Search and Rescue Office and connecting "Breezeway" will be completely demolished, and will be replaced with a single-storey building comprised of new living quarters. The newly constructed building will be situated approximately 6 m to the south of the Lighthouse Keeper's Dwelling, and some of the existing deciduous and coniferous trees will be removed to create the footprint. The living quarters will be contained within a newly constructed structure, in a new 268 m^2 footprint and location on the property, differing from the existing office and breezeway locations, and larger than the existing footprint. The new building will house five (5) bedrooms, two (2) washrooms, a laundry room, storage room, fitness room, ready room and vestibule, kitchen and dining area, and an outdoor deck area.

Figure 4-1 Construction Site Plan

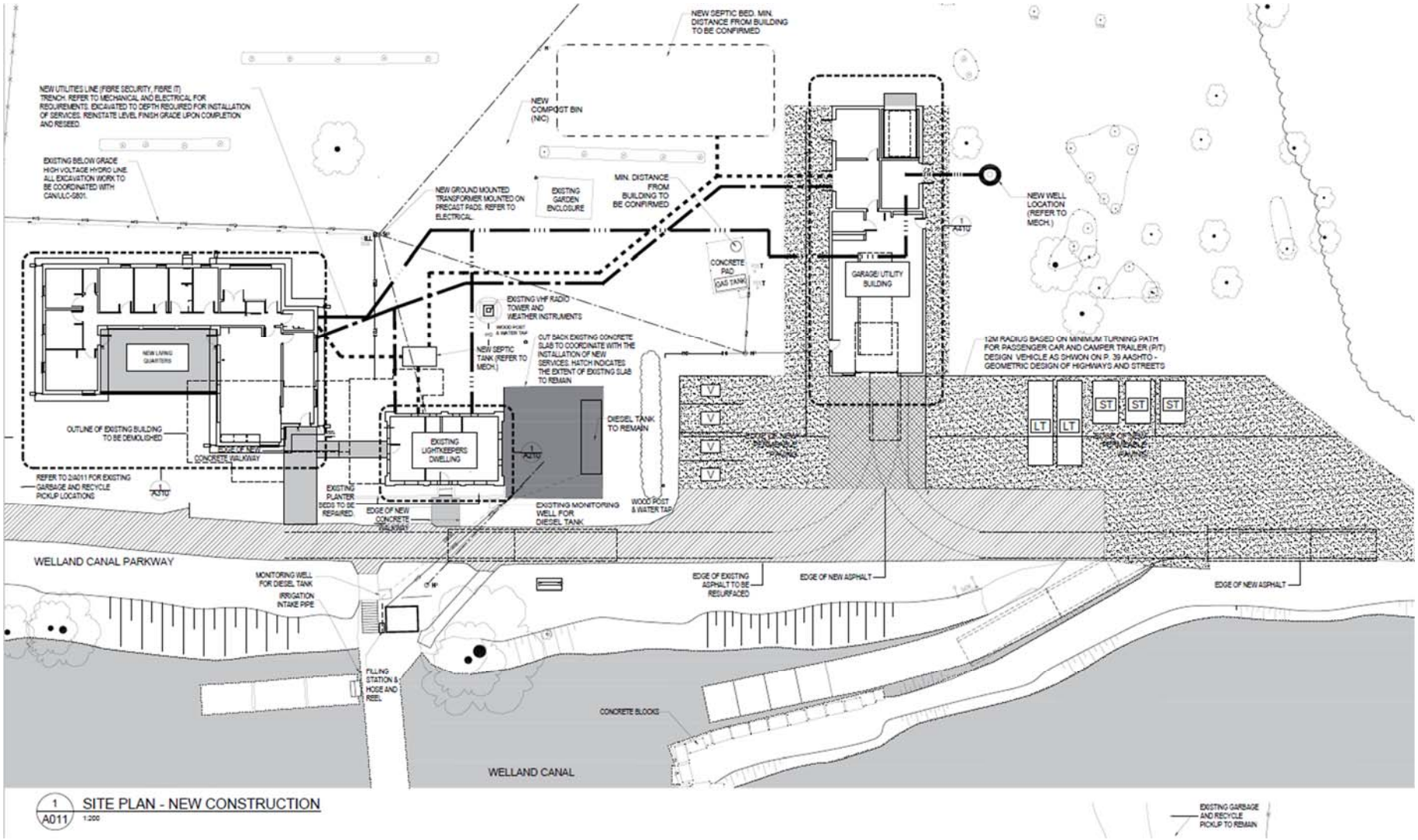


Figure 4-2 New Living Quarters - New Work Roof Plan

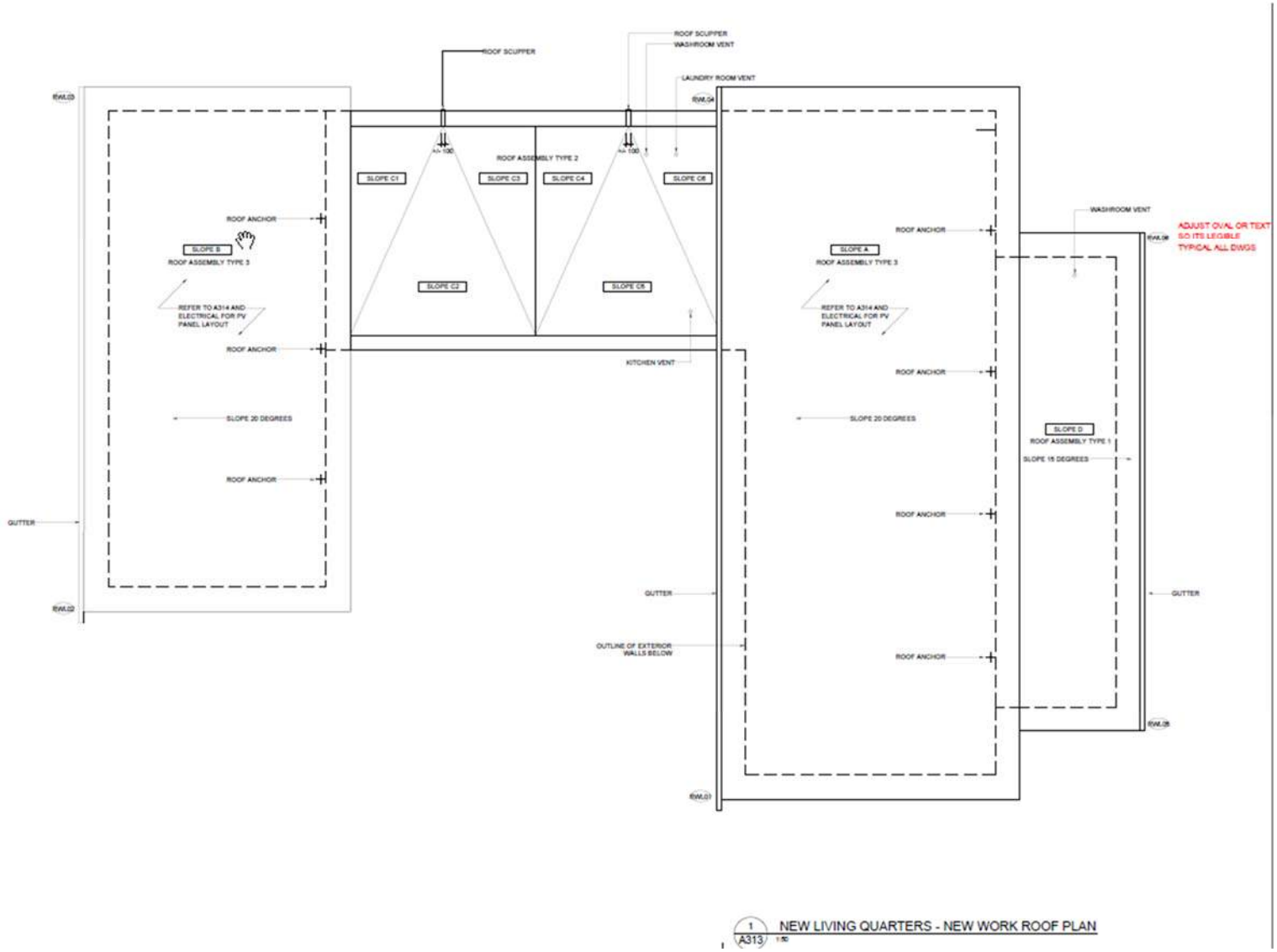


Figure 4-3 New Living Quarters – New Work Plan

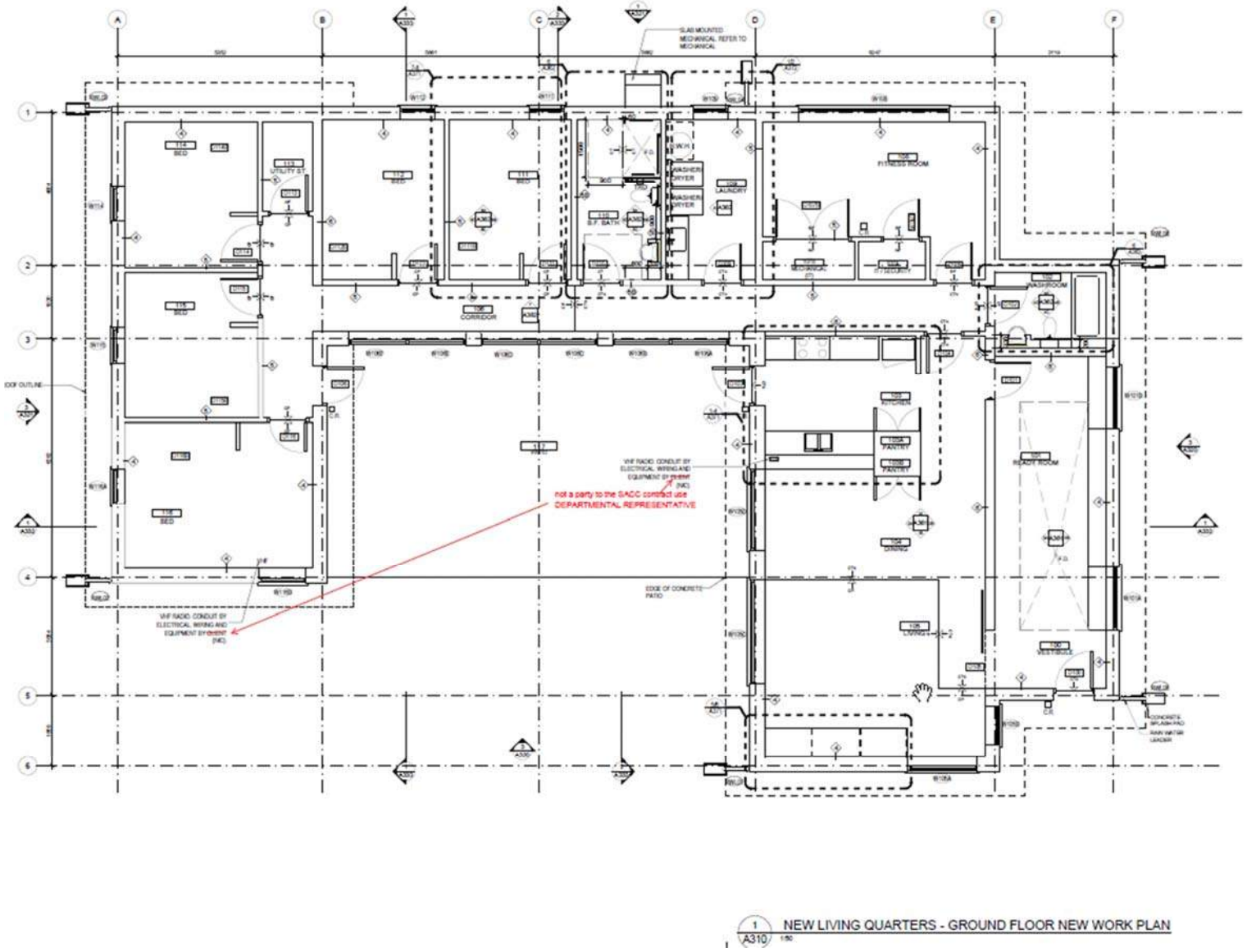
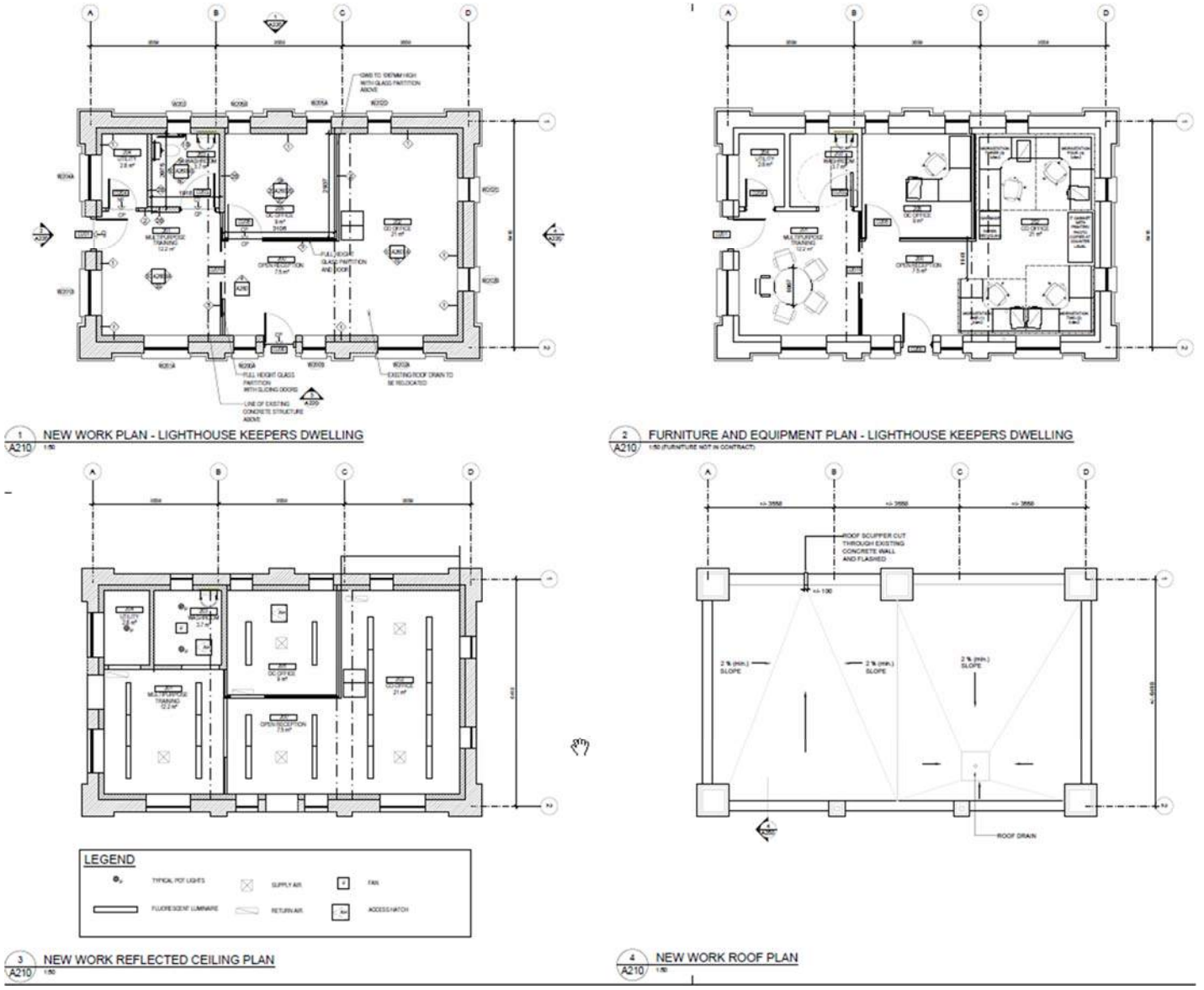


Figure 4-4 New Work Plan for Lighthouse Keeper's Dwelling



Ancillary Structures

On-site ancillary structures, such as the Engineer's Office, "Hoop House", "Rope Locker", "Bread Box" (Storage Building), and "Homer Trailer" (Wooden Garden Storage Structure) as well as their associated concrete slab structures are slated for demolition.

The one existing underground water well on site to the east of the existing Search and Rescue Office building will be decommissioned. A new underground water well will be installed to better accommodate the new structures to the north and east of the Lighthouse Keeper's Dwelling. A new septic line and new utilities line will be installed as part of the new works, in addition to the resurfacing of existing asphalt located by the shore on the west side of the structures (part of the Welland Canal Parkway). New permeable asphalt will be installed adjacent to the existing asphalt to the immediate north and south of the new garage structure, which will include new dedicated vehicle parking spaces for four vehicles as well as dedicated parking for three (3) small trailers and two (2) large trailers.

The above-mentioned changes are all detailed in Figures 4-5 to 4-8.

Fuel/Oil Storage

As of this point, it is our understanding that all of the existing on-site fuel tanks will be retained, but some may be relocated.

Additional Works

In March 2018, it was confirmed that additional works are slated to take place at the Port Weller Coast Guard site which will include the construction of a new garage structure at one of two possible locations, the decommissioning of the existing septic bed (and installation of a new septic bed to the southwest of the current bed), and the removal of up to twenty (20) trees, depending on the location selected for the construction of the new garage structure. The existing water well will be decommissioned and a new water well and water line will also be installed on site.

Figures 4-5 to 4-8 show the Garage Structure Plan and New Works and Demolition Options (1 and 2), which were provided by PSPC. At this time, the exact option for demolition and construction of the garage structure has not been finalized and thus both options are considered in this assessment of environmental effects.

Figure 4-5 Plan for Option 1 – Demolition

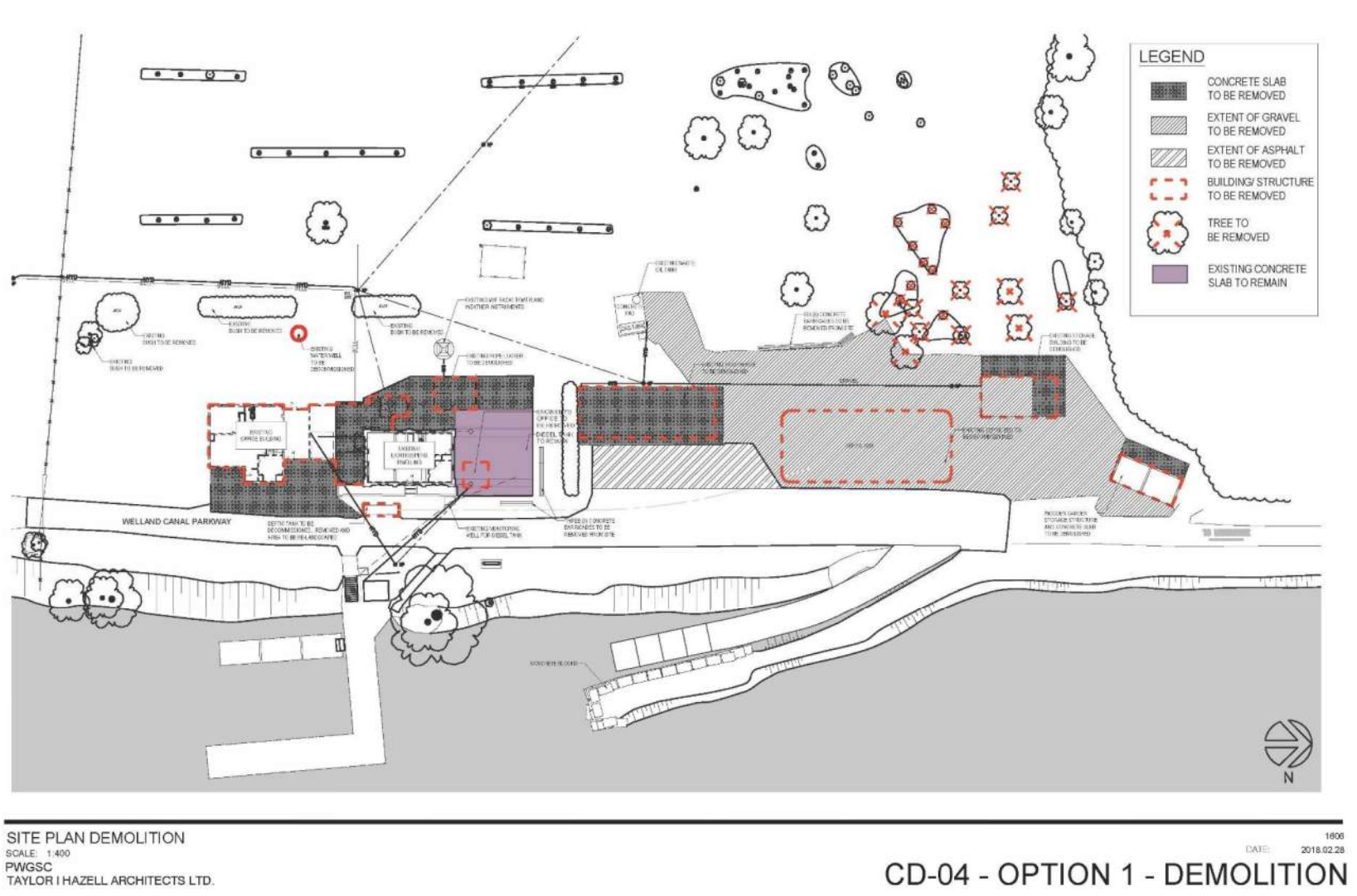
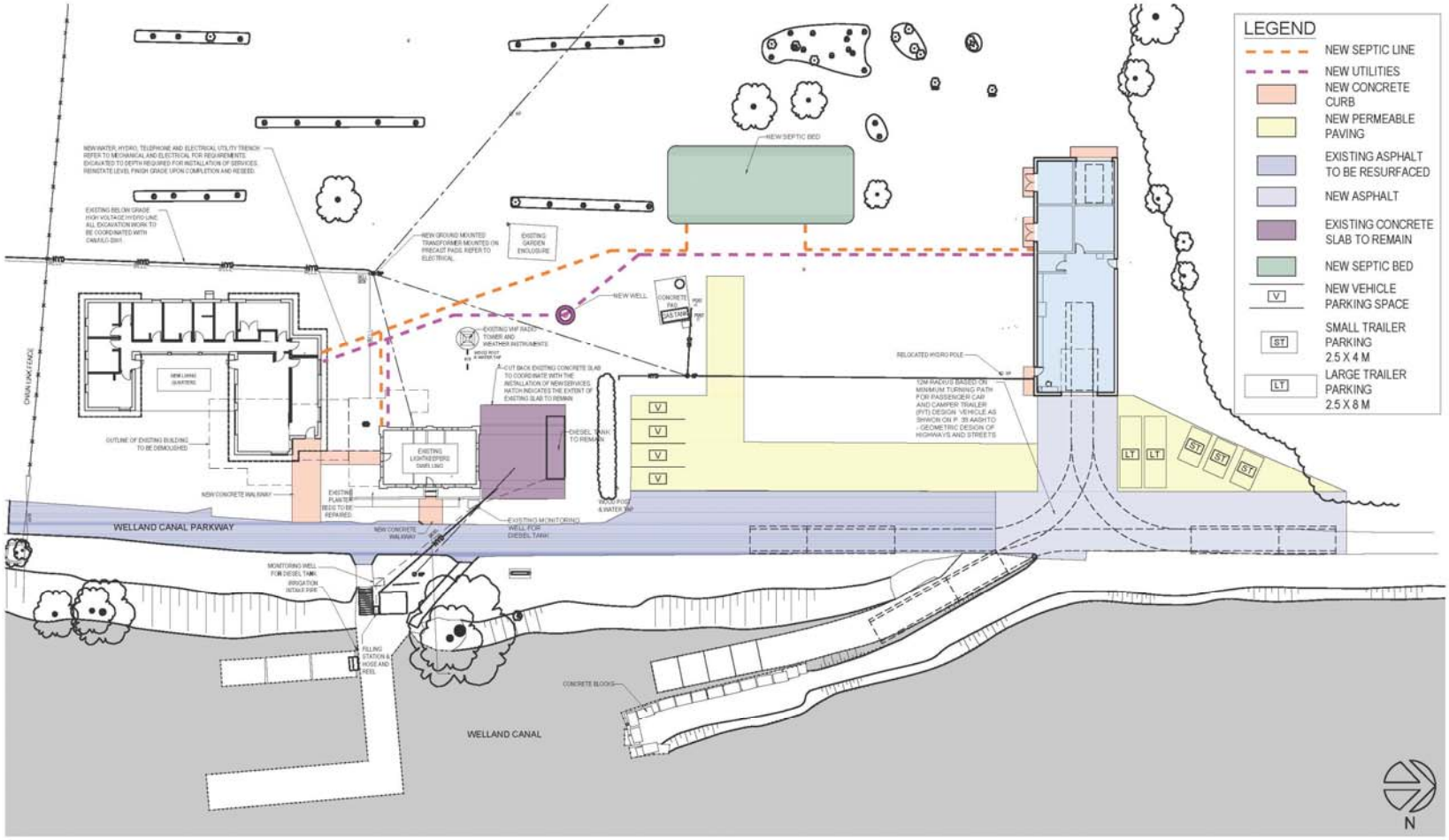


Figure 4-6 Plan for Option 1 – New Work



SITE PLAN NEW WORK
SCALE: 1:400
PWGSC
TAYLOR I HAZELL ARCHITECTS LTD.

1606
DATE: 2018.02.28

CD-05 - OPTION 1 - NEW WORK

Figure 4-7 Plan for Option 2 – Demolition

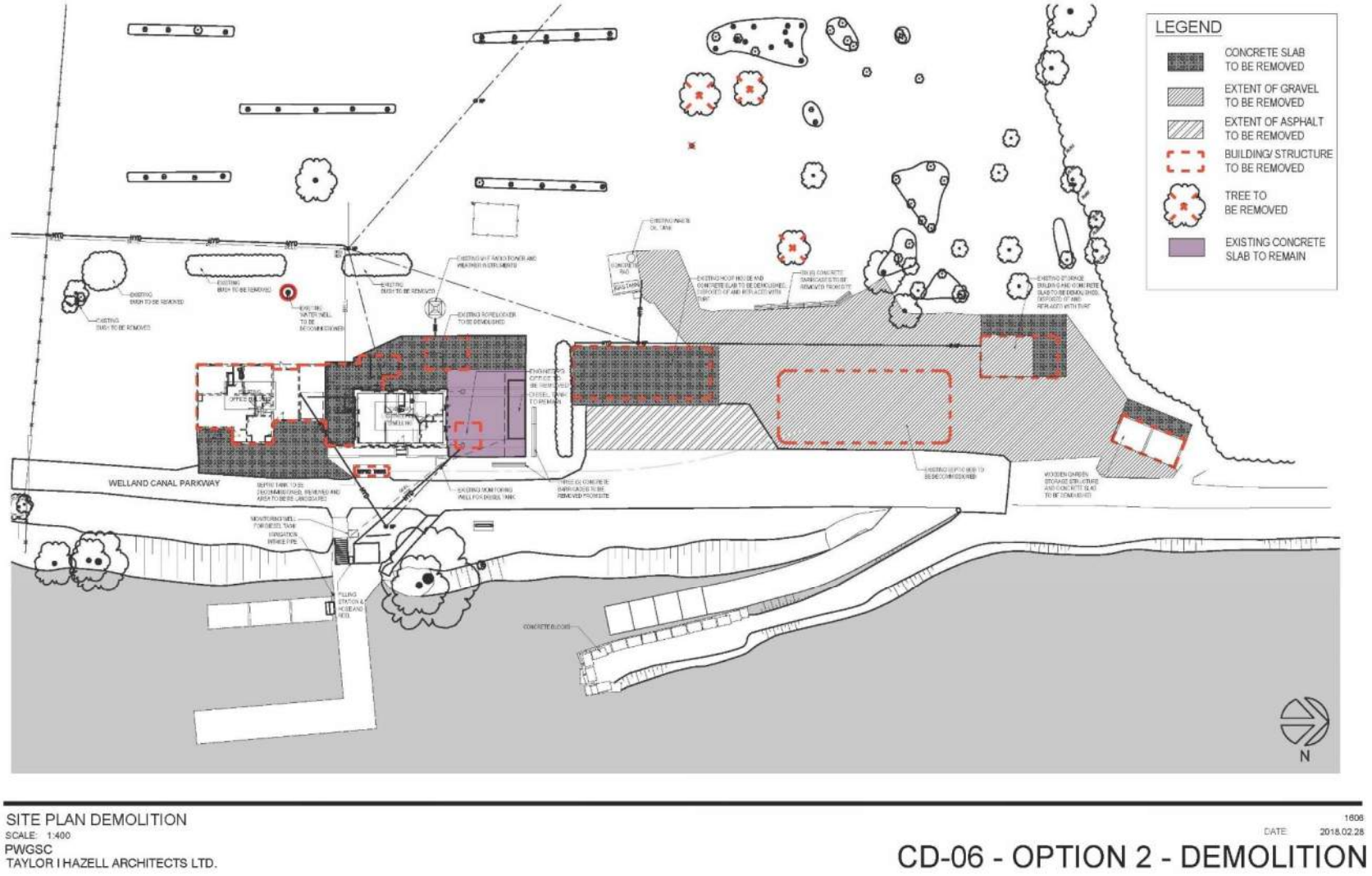
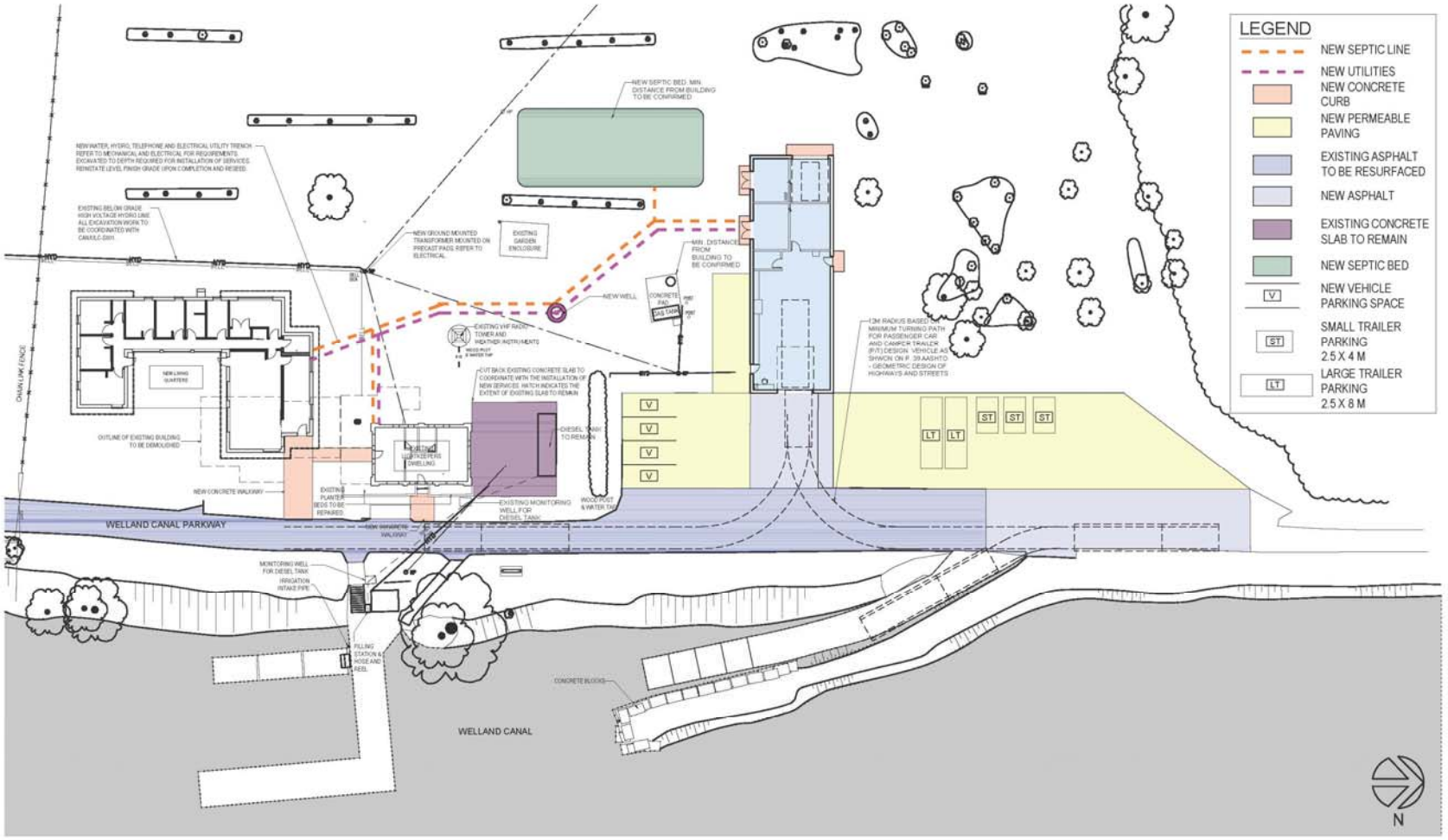


Figure 4-8 Plan for Option 2 – New Work



SITE PLAN NEW WORK
SCALE: 1:400
PWGSC
TAYLOR I HAZELL ARCHITECTS LTD.

1606
DATE: 2018.02.28

CD-07 - OPTION 2 - NEW WORK

The majority of the construction for the proposed project is planned to be completed over the coming winter, from November 2018 to March 2019 (when the buildings are vacant due to the halt of the search and rescue season over the winter months).

The materials to be used for the construction of the new building and garage structure, which will be comprised of stick build structures, include slab on grade assembly concrete foundations, exterior concrete block walls, engineered wood joists, gypsum wallboard for the creation of interior rooms, exterior metal paneling, and standing seam metal roofs.

The buildings are slated to model current sustainability standards (e.g., the project is poised to model LEED standards), albeit full certification will not be pursued. They are likely to be powered by solar and/or geothermal energy. Fifty-six roof mounted photovoltaic solar panels are planned for installation on the roof of the new garage structure.

19. Location of Project:

The project is located at Port Weller – West Pier, City of St. Catharines, Regional Municipality of Niagara, Ontario (see Figure 3-1).

5.0 NATURAL ENVIRONMENT AND CULTURAL RESOURCES

20. Environment Description:

It should be noted that no ecological field investigations, soil, water or sediment sampling were conducted for this project as part of this PED, with the exception of a spring vegetation survey on May 18, 2018, in order to assess the potential effects of removal of some vegetation on the Port Weller property. As a result, the information in this chapter is mostly based on the review of previous studies conducted at the subject site, and made available to Arcadis by PSPC, and visual observations made during the Arcadis site visits on September 14, 2017 and May 18, 2018.

5.1 Physical Environment

Soils

The subject site is located on fill material that was reportedly from the construction of the adjacent Welland Canal in the early 1900s. No records could be obtained regarding the source of the fill. Soils encountered in the boreholes dug by Aqua Terre Solutions Inc. in a 2009 Phase I/II Environmental Site Assessment (ESA) generally consisted of silty or clayey fill (Aqua Terre Solutions Inc., 2009).

A recent Phase I ESA has been completed by Englobe (2018) on behalf of PSPC and the DFO, in order to identify any actual or potential areas of environmental concern since the previous Phase I ESA conducted by Aqua Terre in 2009. The Phase I ESA detected one (1) Area of Environmental Concern and one (1) Area of Potential Environmental Concern (APEC). The AEC is associated with fill material of unknown quality at the subject site including known soil and groundwater impacts uncovered in previous investigations. Known contaminants of concern located in the identified fill include metals (beryllium, copper, lead, and zinc), in addition to pH, and chloride and uranium in the groundwater.

The APEC is associated with the current and historic handling and storage of liquid fuels at the subject site in six above ground storage tanks (ASTs), including the associated underground piping which extends form the 11,000 L diesel fuel AST to the fuel dispenser located along the eastern portion of the site (Figure 3-15 and Figure 3-16). Due to the present and past handling and storage of the liquid fuels in the ASTs, it is suspected that the following contaminants of concern are present at the site: PHC F1-F4, BTEX, VOCs and/or metals. However, this would need to be confirmed via a Phase II ESA investigation.

A Phase II ESA has been recommended as a result of the identification of the AEC and APEC at the site, and an enhanced Phase II ESA is currently being undertaken. However, the results of this work are not yet available as the studies are not yet complete.

Mitigation measures are included in Chapter 7 of this PED.

Groundwater

The site's domestic water is provided by a groundwater water well located on-site on the west side of the main structure. A well pump is used to bring the collected water into the buildings where it is treated in the boiler room. Figure 5-1 shows the on-site well location. The CCME Phase I/II Environmental Assessment (ESA) of the subject site completed by Aqua Terre Solutions Inc. on behalf of PWGSC, concluded that inorganic parameters analyzed in the potable water sample was reported at concentrations which satisfied the applicable CCME guidelines with the exception of the aesthetic objective for sodium (Aqua Terre Solutions Inc., 2009). The existing water well will be decommissioned as part of the partial demolition and addition project, with a new well slated to be installed slightly north of the existing Lighthouse Keeper's Dwelling building, to better accommodate the new structures to the north and east of the Lighthouse Keeper's Dwelling.

As mentioned above, the AEC identified in the Phase I ESA conducted by Englobe (2018) is associated with fill material of unknown quality at the subject site, including known groundwater impacts uncovered in previous investigations, consisting of chloride and uranium detected in the groundwater. In addition, the identified APEC correlated with the six ASTs and piping associated with the 11,000 L diesel fuel AST may have potential affects on the environmental quality of the groundwater. However, a Phase II ESA would need to be completed to confirm any suspected presence of contaminants of concern.

Mitigation measures are included in Chapter 7 of this PED.

Surface Water

The Site is situated on a narrow peninsula, with the Welland Canal to the east and Lake Ontario to the West. Due to heavy rains, elevated lake levels, and strong wave action in Lake Ontario, the western edge of the property adjacent to the lake has experienced some significant erosion, especially in recent times, as shown on Figure 5-2.

Figure 5-1 On-Site Potable Water Well Location

Figure 5-2 Evidence of Erosion

Air Quality

The air quality at the subject site is expected to be good. The site property is bounded to the north and south by dense forest and to the east and west by the Welland Canal and Lake Ontario, respectively. There are no residences, commercial and industrial facilities, in the immediate vicinity of the subject site. The closest major facility to the site is Port Weller Wastewater Treatment Plant which is located approximately 1.2 km to the south of the site. No odours from the plant were detected at the site during both field visits.

5.2 Natural Heritage

The primary federal regulation pertaining to species protection is the federal *Species At Risk Act* (*SARA*). Federal designations of species at risk (SAR) are listed under Schedule 1 of *SARA* which provide for the protection of wildlife and plant species and their critical habitat across Canada. Certain prohibitions apply to species when species are listed on Schedule 1 which include extirpated, endangered, threatened or special concern designations. In Ontario, the provincial *Endangered Species Act (ESA*) prohibits the harming and harassment of protected species and damage or destruction to their habitat. The Species at Risk in Ontario (SARO) List is the official list of endangered, threatened, special concern and extirpated animals and plants in Ontario. It is provided in Ontario Regulation 230/08.

Background information on the natural heritage of the Port Weller Coast Guard Station site was gathered from:

1. Natural Heritage Information Centre (NHIC);
2. Land Information Ontario (MNRF, 2017b);
3. Niagara Peninsula Conservation Authority (NPCA);
4. Ontario Breeding Bird Atlas (Bird Studies et al., 2006);
5. Ontario Reptile and Amphibian Atlas (Ontario Nature, 2015); and
6. Ontario Mammal Atlas (Ontario Nature, 1994).

5.2.1 Terrestrial Environment

The Port Weller site does not contain any Areas of Natural and Scientific Interest (ANSIs) nor does it contain a provincially significant wetland (PSW) (NHIC, 2017).

The terrestrial environment at the Coast Guard Station consists of mostly open landscaped areas composed of manicured grasses, shrubs and bushes with some mature deciduous trees that have been planted; as shown on Figure 5-3. There are no zones of continuous forest cover on the subject site. Since the site is located on a manmade peninsula, the vegetation community consists of native and non-native colonizer species, and is either the subject of natural succession (in the more densely vegetated areas to the north and south of the subject site) or has been planted by CCG personnel within the last 17 to 20 years. Vegetation on the landscaped portion of the subject site are planted species consisting of Eastern white cedar (*Thuja occidentalis*), white ash (*Fraxinus*

americana), poplar (*Populus* sp.), silver maple (*Acer saccharinum*) red-osier dogwood (*Cornus stolonifera*) and day-lily (*Hemerocallis fulva*) (Figure 5-4). Most of the shoreline around the subject site has been previously disturbed, i.e., cultural land, parking lots (paved areas) and access road. Mature willows (*Salix* spp.) are growing along the shoreline. Deciduous forest is present in the vicinity of the site (to the north and south of the subject site).

A variety of avian species were observed during the May 18, 2018 site visit which consisted of American robin (*Turdus migratorius*), Baltimore oriole (*Icterus galbula*), tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), warbler (*Dendroica* spp.), Canada goose (*Branta canadensis*), American goldfinch (*Spinus tristis*), red-winged blackbird (*Agelaius phoeniceus*), gull (*Larus* spp.), and killdeer (*Charadrius vociferus*). Of the species observed at the subject site, only one species is listed as 'threatened' under *SARA*: barn swallow (see Table 5-1). This species was observed nesting on the exterior of the Lighthouse Keeper's Dwelling, specifically in the soffit or fascia of the front of the building.

The Provincial MNRF provided a list of Species at Risk (SAR) known to be present in the City of St. Catharines (Table 5-1). In addition, data on SAR in the immediate vicinity of the site was obtained from NHIC (2013).

Table 5-1 SAR Known to be Present in St. Catharines

Species	Scientific Name	*Endangered Species Act* (*ESA*) Designation	SARA Designation/ Schedule 1 (COSEWIC, if different)
Birds			
Acadian flycatcher	*Empidonax virescens*	END	END
Bank swallow	*Riparia riparia*	THR	No Status (THR)
Barn owl	*Tyto alba*	END	END
Barn swallow	*Hirundo rustica*	THR	No Status (THR)
Black tern	*Chlidonias niger*	SC	Not At Risk
Bobolink	*Dolichonyx oryzivorus*	THR	No Status (THR)
Canada warbler	*Cardellina canadensis*	SC	THR
Cerulean warbler	*Setophaga cerulea*	THR	SC (END)
Chimney swift	*Chaetura pelagica*	THR	THR
Common nighthawk	*Chordeiles minor*	SC	THR
Eastern meadowlark	*Sturnella magna*	THR	No Status (THR)
Eastern whip-poor-will	*Caprimlugus vociferus*	THR	THR
Eastern wood-pewee	*Contopus virens*	SC	No Status (SC)
Golden-winged warbler	*Vermivora chrysoptera*	SC	THR
Peregrine falcon	*Falco peregrinus anatum/ tundrius*	SC	SC
Red-headed woodpecker	*Melanerpes erythrocephalus*	SC	THR

Table 5-1 SAR Known to be Present in St. Catharines (Cont'd)

Species	Scientific Name	*Endangered Species Act* designation	SARA designation/ Schedule 1 (COSEWIC, if different)
Wood thrush	*Hylocichla mustelina*	SC	No Status (THR)
Yellow-breasted chat	*Icteria virens*	END	SC (END)
Insects			
Monarch butterfly	*Danaus plexippus*	SC	SC (END)
Rusty-patched bumble bee	*Bombus affinis*	END	END
West Virginia white	*Pieris virginiensis*	SC	Not Listed
Mammals			
Eastern small-footed myotis	*Myotis leibii*	END	Not Listed
Grey fox	*Urocyon cinereoargenteus*	THR	THR
Little brown myotis	*Myotis lucifugus*	END	END
Northern myotis	*Myotis septentrionalis*	END	END
Tri-coloured bat	*Perimyotis subflavus*	END	END
Reptiles			
Common five-lined skink	*Plestiodon fasciatus*	END	SC
Eastern ribbonsnake	*Thamnophis sauritus*	SC	SC
Snapping turtle	*Chelydra serpentina*	SC	SC
Plants			
American chestnut	*Castanea dentata*	END	END
American columbo	*Frasera caroliniensis*	END	END
American ginseng	*Panax quinquefolius*	END	END
Biennial gaura	*Oenothera gaura*	No Status*	No Status
Broad beech fern	*Phegopteris hexagonoptera*	SC	SC
Butternut	*Juglans cinerea*	END	END
Cherry birch	*Betula lenta*	END	END
Cucumber tree	*Magnolia acuminata*	END	END
Eastern flowering dogwood	*Cornus florida*	END	END
Northern hawthorn	*Crataegus pruinosa var. dissona*	No Status[1]	No Status
Red mulberry	*Morus rubra*	END	END
Swamp rose-mallow	*Hibiscus moscheutos*	SC	SC
Unicorn clubtail	*Arigomphus villosipes*	No Status[2]	No Status
White wood aster	*Eurybia divaricata*	THR	THR
Woodland flax	*Linum virginianum*	No Status[3]	No Status
Fish			
Lake sturgeon	*Acipenser fulvescens*	THR	No Status

[1] SRank: Provincial Conservation Status (NHIC) S3= vulnerable.

[2] SRank: Provincial Conservation Status (NHIC) S2/S3= vulnerable/imperiled.

[3] SRank: Provincial Conservation Status (NHIC) S2= imperiled.

Figure 5-3 Open Landscaped Area

Figure 5-4 Landscape Vegetation

5.3 Cultural and Socioeconomic Resources

As was noted earlier, both the former Lighthouse Keeper's Dwelling and the Search and Rescue Office are designated federal heritage buildings.

The Former Lighthouse Keeper's Dwelling is on the register of Canada's Historic Places under the name, the Former Lighthouse Keeper's Dwelling. It is identified as being built in 1931 and was formally recognized in 1989. The designation is confined to the footprint of the building. The character-defining elements of the Former Lighthouse Keeper's Dwelling should be respected. These elements include its good Art Deco aesthetic, functional design and excellent quality materials and craftsmanship. The manner in which the Former Lighthouse Keeper's Dwelling is compatible with the present character of the maritime setting at the end of a breakwater, and is a familiar regional landmark for maritime traffic as evidenced by:

- the design and form, which complement the location at the end of a breakwater, and
- the structure's visibility to passing maritime traffic makes it a familiar landmark. (Taylor Hazell Architects Ltd., 2016).

The Search and Rescue Office, also known as the 1953 Residence, is a Recognized Federal Heritage Building because of its historical associations, and its architectural and environmental values. The Search and Rescue Office and adjacent dwelling, through its association with the lighthouse station, is associated with the provision of navigational aids to ensure the safe usage of the Welland Canal. (Taylor Hazell Architects Ltd., 2016).

Due to the nature of its operations, access to the Port Weller Coast Guard Station site is strictly controlled by a locked gate located approximately 1.2 km from the site, adjacent to the Port Weller Wastewater Treatment Plant (see Figure 5-5). The site is not available for common public use and the property boundaries to the north and south are fenced.

5.4 Construction Equipment Site Access

A two-lane paved roadway (which is part of the Welland Canal Parkway) is the only land access to the site. This roadway is exclusive to the site beyond the locked gate. All construction vehicles and heavy equipment involved in the proposed project would have to utilize this roadway.

While details pertaining to the location of laydown/staging area for the proposed construction are yet to be confirmed, it is anticipated that the gravel parking lot and/or the landscaped area to the south and west of the existing on-site buildings will be used for this purpose.

Figure 5-5 Controlled Entrance to Port Weller Coast Guard Station

6.0 ENVIRONMENTAL EFFECTS

6.1 Scope of Effects Considered

21. Scope of Effects Considered (section 5(1) and 5(2)):

The following components of the environment were considered in the assessment of potential environmental effects of the proposed project:

- air;
- soil and landscape;
- groundwater;
- surface water;
- terrestrial flora and fauna;
- cultural resources.

This chapter only addresses potential effects. Mitigation of potential effects are discussed later in Chapter 7.

6.2 Environmental Effects Analysis

22. Environmental Effects:

6.2.1 Natural Resources / Natural Environment

Air

As the proposed project primarily entails building demolition/construction, and some excavations for building foundations, the effects on air quality are expected to be minimal. Hydrocarbon emissions are expected from the small number of gas/diesel powered heavy construction machinery such as a bobcat or backhoe and construction vehicles, but the rest of the equipment will be mainly comprised of electric power tools. It is also anticipated that demolition/construction activities would generate some noise, but this noise would be temporary and localized to within the site boundary. Furthermore, there are no residences or other facilities in close proximity to the site; thus, no nuisance noise effects are anticipated. The same applies to dust.

Soil and Landforms

Phase II ESA soil investigations in the vicinity of the on-site ASTs completed by Aqua Terre Solutions Inc. in 2009 indicated that no petroleum hydrocarbon (PHC) fractions soil impacts were encountered. Therefore, it was concluded that the tanks have little subsurface impacts, if any. Visual observations made by Arcadis during the September 2017 site visit indicated that all of the storage tanks appeared to be in generally good condition and no obvious signs of staining was observed on the concrete pads immediately beneath the storage tanks, or on the surrounding soil. This was also the case during the site visit made by Arcadis in May 2018.

Shallow soil sampling of fill underlying the site was conducted by Aqua Terre Solutions Inc. in 2009 in conjunction with soil sampling around the ASTs. No poor-quality fill was encountered, and Aqua Terre Solutions Inc. concluded that fill quality is not a concern. As was noted above in Section 5.1, however, the Phase I ESA completed by Englobe in 2018 identified one (1) AEC and one (1) APEC. The AEC consists of known contaminants of concern linked to the fill material of unknown quality used at the site in the early 1900s (beryllium, copper, lead, and zinc). The APEC is associated with the ASTs on site and underground piping. The completion of a Phase II ESA was also recommended, further to the Phase I studies. The Phase II ESA, which is currently underway, will provide additional details on the extent of the contamination and mitigation measures which are to be implemented, as necessary.

All of the existing on-site fuel and oil storage tanks are located above ground and are quite visible, hence there is a very low likelihood of accidental impact resulting in the loss of fuel or oil. There is a potential, however, for accidental fuel/oil/diesel/other chemical spills on land, especially in the construction staging/laydown areas, from vehicles and heavy equipment used for undertaking the construction. However, this potential effect can be mitigated as will be discussed later in Chapter 7.

At this point, it is assumed that the gravel/paved parking lot will be used as the construction staging/laydown area. If this is the case, there will be little to no potential for soil compaction or erosion. However, if the existing landscaped grassy area to the south and west of the main structure is used for construction staging/laydown, then the potential for soil compaction increases.

Up to twenty (20) trees are slated for removal in the northern portion of the subject site, in order to accommodate the installation of the new septic bed and construction of the new garage structure, as well as the installation of a new water well and new utility lines (for septic and water). In this case, the machinery used for tree removal and construction machinery used to construction the new structure and install the new septic bed, such as a bobcat or backhoe, and other vehicles, may increase the likelihood of soil compaction in this area of the subject site. Soil quality and drainage can potentially be affected by compaction caused by machinery/equipment as well as from people on-site. Soil compaction may result in reduced water/soil infiltration rates increasing surface runoff and potential siltation to surface water (e.g. in drainage systems during wet weather events).

As can be seen from the detailed project description provided in Chapter 4 of this PED, none of the proposed project activities are expected to cause any major effect on landforms. The proposed project does not involve any major excavation of land, construction of new roads, and will for the most part be limited to the footprint of existing on-site structures and existing landscaped area. Furthermore, the subject site is flat and does not pose any special challenges for undertaking the proposed construction activities.

As was shown in Figure 5-2, the western edge of the subject property, which borders Lake Ontario, has experienced noticeable erosion in recent times due to higher water levels in the lake. The current construction plan contemplates locating the new building and ancillary structures north and east of the current building footprint, but with adequate set-back from Lake Ontario, therefore no additional erosion effects are anticipated as a direct result of the proposed project.

Groundwater

As was noted earlier, and shown on Figure 5-1, the subject property is serviced by an on-site potable water well. The location of the proposed new building and the new garage structure will necessitate relocation of the existing water line, decommissioning of the existing water well and installation of a new water well to better accommodate the new structures to the north and east of the Lighthouse Keeper's Dwelling. A new water line will extend further north as well. A new septic line will also be installed as part of the new works.

Englobe (2018) identified chloride and uranium as known contaminants of concern at the site in the groundwater, and this should be taken into consideration during the excavation and earthworks associated with removal and installation of water wells and septic lines. Chloride and uranium are naturally occurring substances. Uranium is a component of all rocks and soils and is commonly found in groundwater. Levels of uranium in soils and groundwater depends on the characteristics and nature of parent rocks and soils. For instance, there will be higher levels of uranium in rocks that are granite in origin, such as in Northern Ontario, and lower in Southern Ontario silty clay soils. The detection or presence of uranium is not an issue per se; however, mitigation measures outlined in Chapter 7 must be adhered to.

Gravel/paved areas are expected to be used for project staging/laydown and trucks and other equipment involved in the construction will travel along paved access routes, so the likelihood of fuel/oil/chemical spills in areas that could affect groundwater is slim.

Surface Water

The Port Weller Coast Guard Station property is bounded by the Welland Canal on its east side, where the search and rescue vessels are moored, and Lake Ontario on its west side. There are no on-site surface water features. None of the proposed project construction is slated to occur east of the current building footprint, or closer to the Welland Canal. While the staging/laydown area is expected to be on the east side of the property, this location would be greater than 30 m from the Canal.

No construction is planned to occur within 30 m of Lake Ontario on the west side of the subject site.

Thus overall, the proposed project is not expected to cause any adverse surface water effects.

Fish and Aquatic Biota

Since the proposed project activities are expected to be well removed from surface water features, no adverse effected are anticipated for fish and aquatic biota.

Terrestrial Flora

No impact to local native plant diversity in the woodlot surrounding the Site is anticipated as a result of the proposed project construction. Laydown areas are expected to be on gravel/paved areas only. Any potential impact associated with the proposed project would be minor. Other than access to work areas, landscaped areas will be affected due to the removal of between nine and twenty trees which are situated in the landscaped area where construction of the new building, new garage

structure, new water well, installation of the new septic bed, and new septic and water lines will take place, with the exact number of trees slated for removal to be confirmed once the demolition and construction configuration option is selected. Some of the trees proposed for removal are displayed in Figures 6-1 to 6-4. During the May 2018 site visit, it was confirmed that all of these trees are landscape planted trees, as mentioned in Chapter 5, and are mostly Eastern white cedar, white ash, silver maple and red-osier dogwood. CCG personnel confirmed that all trees in the manicured portion of the subject site were planted approximately 17 to 20 years prior, and removal of the trees will create minimal impact, as they do not provide extensive breeding or feeding habitat or shelter for wildlife. Better suitable tree and shrub communities are available in the vicinity of the site. Potential impacts such as trampling of manicured lawns would be considered minimal and temporary and full recovery of affected grassed areas would be expected. Effects on plant SAR are not expected as no plant SAR are present in the landscaped areas.

Figure 6-1 Trees Likely Slated for Removal (Northern Extent of Site)

Figure 6-2 Trees Likely Slated for Removal (Northern Extent of Site)

Figure 6-3 Trees Likely Slated for Removal (Southern Extent of Site)

Figure 6-4 Trees Likely Slated for Removal (Southern Extent of Site)

Terrestrial Fauna

Noise and human presence may cause potential nuisance effects on wildlife. However, since wildlife on and in the vicinity of the site is adapted to urban environments and is highly mobile, significant effects are not expected.

The subject site does provide habitat to one known SAR, barn swallow, as observed during the May 2018 site visit. Barn swallows were observed flying to and from the fascia and soffit of the Former Lighthouse Keeper's Dwelling, and it is assumed that the species was nesting in this location. Thus, they may be disturbed if any of the demolition and construction activities were to take place during the spring nesting season. However, since project activities are slated to take place over the winter season, from November 2018 to March 2019 (when the buildings are vacant due to the halt of the search and rescue season over the winter months), it is not likely that the project activities would impact the barn swallow, since the species is absent during this time.

It is not anticipated that any SAR or migratory bird species would be affected by the proposed project if appropriate mitigation measures are implemented and maintained.

6.2.2 Cultural Resources

Both the Former Lighthouse Keeper's Dwelling (constructed circa 1931), and the 1950's addition which is referred to as the Search and Rescue Office are Federally Designated Historic Places. As noted earlier, the proposed project would entail completely demolishing the Search and Rescue Office and Breezeway while keeping the Former Lighthouse Keeper's Dwelling intact. The demolition of the Search and Rescue Office means the loss of a historic building. In recognition of this fact, DFO has contacted the Federal Heritage Buildings Review Office (FHBRO) to alert FHBRO of the proposed demolition plans.

6.2.3 Socioeconomic Effects

Due to the relatively small size of the proposed project, it is unlikely that it would have a noticeable socio-economic impact. It is unlikely that new construction jobs will be created because of the project; but if this happens, the number of jobs will be very small and short-term, throughout the duration of the project. No adverse socio-economic effects are anticipated as the proposed project is unlikely to directly, or indirectly affect local or distant communities.

6.2.4 Potential Effects of Hazardous Building Materials and Designated Substances

Due to the age of the Former Lighthouse Keeper's Dwelling (constructed circa 1931) and the Search and Rescue Office (constructed in 1953), there is a potential that hazardous building materials such as asbestos, and designated substances such as lead paint, were used in their original construction. To verify the status of such materials in the existing buildings, Arcadis reviewed the following documents provided by PWGSC:

- PWGSC, Project-Specific Designated Substances Survey – Galley House and Office House Fisheries and Oceans Canada, Port Weller, Ontario, prepared by DST Consulting Engineers, February 13, 2017.
- Taylor Hazell Architects Ltd., Search and Rescue Station, Building Condition Report Investigation and Test Scope and As built Drawing, August 2016.
- Pinchin Environmental, Hazardous Building Materials Assessment, Fisheries and Oceans Canada, Port Weller, St. Catharines, Ontario, April 3, 2014.
- Aqua Terre Solutions Inc., CCME Phase I/II Environmental Site Assessment Search and Rescue Station, Port Weller, Ontario, Final Report, February 11, 2009.
- Englobe. Update Phase I Environmental Site Assessment Report, 4 Welland Canals Parkway, St. Catharines, Ontario, March 29, 2018.
- Stantec. Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station, July 13, 2018.

The key conclusions from these previous studies that are pertinent to the current PED are summarized below. Further details can be obtained by reviewing the original documents.

Pinchin Environmental was retained by PWGSC in 2014 to undertake a Hazardous Building Materials Assessment in the two buildings (the Former Lighthouse Keeper's Dwelling and the Search and Rescue Office). The Pinchin study confirmed the presence of the following hazardous materials in the buildings:

- asbestos – in exterior caulking;
- lead – in paint, wiring connectors, grounding conductors, and solder;
- mercury – in fluorescent lamps;
- polychlorinated biphenyls (PCBs) – may be present in fluorescent lamp ballasts;
- silica – in concrete, mortar, brick, masonry and ceramic; and,
- mould – on drywall and concrete.

The presence of these hazardous building materials poses a potential occupational health risk to individuals who are stationed at the site and are exposed to such materials, and to construction workers who may come in accidental or careless contact with the materials.

DST was retained by PWGSC in 2016 to prepare a project-specific Designated Substance Report (DSR) for the Office House and Galley House located at the DFO Port Weller facility. The DST survey included the following 11 designated substances listed in Section 30 of the *Occupational Health and Safety Act*, R.S.O. 1990, Chapter 0.1. Designated Substances, as identified under the Ontario *Occupational Health and Safety Act*, are as follows:

- Acrylonitrile;
- Arsenic;
- Asbestos;
- Benzene;

- Coke Oven Emissions;
- Ethylene Oxide;
- Isocyanates;
- Lead;
- Mercury;
- Silica; and
- Vinyl Chloride.

In addition, DST surveyed other Hazardous Materials that are not classified as Designated Substances but were included as part of the survey and considered pertinent due to applicable regulations, best practice guidelines and/or potential risks to human health and/or the environment. They are:

- Polychlorinated Biphenyls (PCBs);
- Halocarbons;
- Mould; and
- Other hazardous materials, as deemed pertinent.

Based on its site investigations, DST concluded that asbestos, lead, mercury, silica, and halocarbons are present in forms and quantities expected to have an impact on future work operations at the site.

Stantec was retained by PSPC in 2018 to prepare a Designated Substances and Hazardous Building Materials (DSHM) Assessment for the North Storage Shed and North Storage Bin, in order to identify any potential designated substances and hazardous building materials that may require special attention prior to the planned demolition activities associated with the Port Weller Search and Rescue Station Upgrade Project. In addition to designated substances, the hazardous building materials considered in the assessment included PCBs, ozone-depleting substances (ODSs), urea-formaldehyde foam insulation (UFFI), mould, and radioactive sources. As part of the study, a visual assessment was also conducted for chemical, fuel, oil, and/or waste oil storage, and for treated lumber applications that could contain creosote or arsenic. The assessment uncovered evidence of the following substances at the north storage shed (Bread Box) and north storage bin (Homer Trailer), or their likely presence:

- Asbestos;
- Lead;
- Mercury;
- Silica; and
- PCBs.

Mitigation measures outline in Section 7.3 must be followed with respect to hazardous building substances.

7.0 MITIGATION MEASURES

23. Mitigation Measures for Project (including Habitat Compensation if applicable):

Mitigation measures for potential environmental effects of the proposed Port Weller project are outlined in sections 7.1 to 7.3 below.

7.1 Natural Resources / Natural Environment

Air

As was noted in Chapter 6, the proposed project is unlikely to generate any nuisance noise because the subject site is secluded from any potential noise receptors. Any noise associated with the construction activities will occur over the short-term and will be localized within the immediate area of the subject site. No noise mitigation is recommended beyond compliance with the time limitation (11:00 pm to 7:00 am, seven days a week) stipulated for construction equipment in the City of St. Catharines "By-law to Prohibit and Regulate Noise - No. 95-198, as amended", and implementation of best construction practices such as ensuring that all construction equipment are well maintained, operate according to the manufacturer's specifications, equipped with appropriate mufflers, etc.

Several measures can be implemented to mitigate the spread of dust during the demolition and construction phases of the proposed project. Dry air and high winds have the potential to cause the release and dispersion of dust emissions. The ECCC publication "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" provides several mitigation measures for reducing emissions during construction activities. Mitigation of dust, as recommended in the ECCC document, can be achieved through the use of wind barriers (i.e., fencing or solid barriers, or trees and shrubs), wetting or non-chloride dust suppressants (including for stockpiled soil), equipment washing, limiting vehicle speeds on unpaved road surfaces, using tarps to secure soil transported to or from the subject site, and limiting the exposed area which may be a source of dust. Given the temporary nature of construction projects, the use of dust suppression techniques, work reduction during high winds and the use of low silt content materials are the most common types of mitigation applied.

Construction vehicles, machinery, other equipment and power tools are potential sources of air emissions exhaust gases, and green house gas emissions. To mitigate the potential effects from these emissions, the use of ethanol blended fuel or biodiesel is encouraged. New or well-maintained machinery/equipment, fitted with fully functioning emission control systems/mufflers/exhaust systems, engine covers, etc., shall be used, to avoid introducing pollutants to the site. In addition, vehicles/equipment should not be left to idle unnecessarily. The City of St. Catharines has an existing by-law 2007-294 regulating the idling of vehicles for purposes related to health and safety. The by-law states that no person shall cause or permit a vehicle to idle for more than three consecutive minutes, except under specific circumstances such as for temperature control, which is unlikely to occur during the construction season.

Soil and Landforms

As was discussed in Chapter 6, Englobe (2018) identified the presence of beryllium, copper, lead, and zinc associated with one on-site AEC. The Phase I ESA identified an APEC associated with the six on-site ASTs and underground piping extending from the 11,000 L diesel fuel tank to the fuel dispenser located along the eastern section of the site. It was recommended that a Phase II ESA be conducted to further investigate the APEC, and that visual inspections of all ASTs shall be conducted on a regular basis. The Phase II ESA investigation is currently underway, and results must be considered, and any mitigation measures recommended must be adhered to. Following previous and recent studies, given the identified and suspected contaminated soils, the following additional mitigation measures are recommended:

- If possible, avoid the stockpiling of contaminated soil and instead load contaminated soil directly onto haulage vehicles. If stockpiling is unavoidable, stockpiled contaminated soils shall be placed on two layers of 8-mil polyethylene sheeting and covered by tarps to prevent the potential for leaching, erosion and sedimentation.
- Maintain effective erosion and sedimentation measures until complete re-vegetation is achieved.
- Remove and dispose of any impacted soil in accordance with applicable legislation such as the federal *Environmental Protection Act, 1999, and* Ontario's O. Reg. 347, and restore area.
- Confirmatory sampling shall be undertaken to ensure that all impacted soils have been removed.

As was noted earlier in Chapter 6, there is a low potential for accidental spillage of fuel/oil/chemicals while undertaking the proposed project. It is recommended that DFO require that a Spill Response Plan must be provided by the contractor prior to the commencement of work. The contractor is responsible to have appropriate containment, spill kit, and clean up equipment on-site in accordance with the approved Spill Response Plan to ensure a rapid response to any spill. Spills are to be reported to Environment Canada – Environmental Emergencies (613-239-6065), the Ontario Ministry of the Environment and Climate Change – Spills Action Centre (1-800-268-6060), and the DFO.

While all existing on-site fuel and oil storage tanks are above ground, visible and clearly marked, additional mitigation, such as curbing or fencing, shall be considered to further reduce the risk of accidental impact. Should the construction phase of the proposed project involve the temporary storage of hazardous materials, such storage of hazardous materials must comply with the Canadian *Environmental Protection Act*. All fuels and chemicals must be stored in secure areas on impermeable pads/surfaces to avoid contamination of soil in the event of a spill. This includes any solvents and oils stored within the auxiliary structures which are slated for removal (such as the Rope Locker). These must be removed, handled, and stored on-site during project demolition activities, in accordance with the above-mentioned legislation.

It is recommended that silt fencing be installed both in the construction staging/laydown area and in the landscaped area where new excavations occur in order to reduce soil loss from surface runoff and/or erosion. New construction should be directed to areas north and south of the existing on-site main building structure, rather than towards the west, which is already subject to erosion from Lake Ontario.

Groundwater

As noted earlier, there is a potable water well at the subject site which is slated for decommissioning and a new water well will be installed slightly north of the Former Lighthouse Keeper's Dwelling, with the installation of a new water line. The existing septic bed will also be decommissioned with the installation of a new septic bed and new septic line. To protect the integrity of the potable water source it is recommended that prior to undertaking excavations, the construction contractor shall verify the depth of groundwater at the excavation site. In addition, the contractor should obtain a baseline water chemistry suite (i.e. general chemistry, including colour, turbidity, total dissolved solids, total suspended solids, metals) before the start of construction. Then on a regular basis during underground construction (excavation, etc.), water samples are to be taken and analyzed for colour, turbidity, total dissolved solids (TDS), and total suspended solids (TSS). This is undertaken to monitor whether construction activities may be affecting the well head due to agitation and vibration during construction. The baseline suite allows for comparative analysis, should changes to the water be observed during construction.

As mentioned in Chapter 6, Englobe (2018) identified the presence of uranium associated with one on-site AEC. The origin of this is likely natural; however, this cannot be confirmed until further testing is conducted. The simple presence of uranium is not an issue per se. It is recommended to conduct assays of uranium content of soil and groundwater that could be used to establish whether or not precautions should be taken and whether or not the groundwater is suitable for use as drinking water. Measurements of uranium should be obtained and compared to local reference soils and in groundwater references. The Health Canada guideline, *Uranium in Drinking Water* should also be referred to. This guideline provides background information on naturally occurring levels of uranium in groundwater. In addition, the Ontario Provincial *Ontario Typical Range* (OTR) information on variability of uranium in soils may also be referred to in order to provide further context. Typical average background levels of uranium are measured at approximately 3 parts per million (ppm), while they can be as high as 10 -12 ppm in granite sources.

As the Phase II ESA investigation for the subject site is currently underway, any results must also be considered, and any mitigation measures recommended must be adhered to.

It is important that the construction contractor(s) ensures that all on-site machinery are operated according to manufacturers' requirements in order to avoid malfunctions that could result in spills. It is recommended that construction workers handle hazardous substances, etc. on an impermeable surface, such as on paved areas.

Storage of hazardous materials must comply with the Canadian *Environmental Protection Act*. All fuels and chemicals must be stored in secure areas on impermeable pads/surfaces to avoid contamination of groundwater in the event of a spill.

Surface Water

To protect surface water, as noted above, it is recommended that silt fencing be installed both in the construction staging/laydown area and in the landscaped area where new excavations occur in order to reduce soil loss from surface runoff and/or erosion.

Large and small construction vehicles and machinery with fuel tanks will likely be travelling to and from the proposed project site. All refueling of the machinery and equipment shall be restricted to designated areas (over an impermeable, paved area, if available) and shall be at least 30 m from any drainage system (i.e. storm water drains) or water body (i.e. lake, canal, ditch, pond).

In addition, it is important that the construction contractor(s) ensure that all on-site machinery are operated according to manufacturers' requirements in order to avoid malfunctions that could result in spills.

Storage of hazardous materials must comply with the Canadian *Environmental Protection Act*. All fuels and chemicals must be stored 30 m from any drainage system (i.e. storm water drains) or water body (i.e. lake, canal, ditch, pond) in secure areas on impermeable pads/surfaces.

Fish and Aquatic Biota

The proposed project is not expected to have any impacts on fish or biota, so mitigation measures are not deemed necessary.

Terrestrial Flora

Machinery/equipment/contractors will be mainly restricted to the defined work and laydown areas to minimize any impacts to the surrounding vegetation. The removal of any on-site shrubs or trees, such as the seven to twenty trees slated for removal as part of the proposed project activities, shall be done outside of the breeding bird season for this area (i.e. early April to the end of August). Any significant damage to the surrounding manicured lawns or vegetation shall be restored to prior or better site conditions by the contractor under the direction of the DFO staff, if necessary. In the case of the need to replant herbaceous or woody vegetation (i.e., if the DFO deems it wishes to replace any trees that will be removed by planting other trees at other locations on the property), native species shall be used. Machinery/equipment shall be properly cleaned before going on-site, and only clean, local soil/aggregate/other materials shall be utilized to avoid the potential introduction of invasive and/or non-native seeds to the site. Appropriate protection measures should also be taken to protect existing trees and shrubs on site which are not slated for removal (e.g., tree fencing, if necessary).

Terrestrial Fauna

Any materials that pose a hazard to wildlife must be stored in secured buildings or containers as directed by DFO.

The disturbance, destruction, or removal of a nest or egg of a migratory bird; or to be in possession of a live migratory bird, or its carcass, skin, nest, or egg, is prohibited pursuant to the *Migratory Birds Convention Act*, and contractors must notify DFO staff immediately of any problem wildlife encounter. The feeding, enticement, or harassment of wildlife is prohibited, and garbage and recycle receptacles shall be utilized to prevent wildlife access to waste products. To protect migratory birds, the removal of on-site shrubs or trees should be occurring outside of the period extending from the beginning of April to end of August.

While no SAR fauna are likely to be encountered at the site, since it is a residence and office site with substantial daily human activity within a disturbed, manicured setting, DFO staff and contractors shall be diligent in monitoring for SAR/wildlife prior to, during, and after the project's activities. Particularly, should the project work begin prior to November, when possible, wildlife will be given the opportunity to escape the work area to surrounding areas to seek new shelter, e.g., equipment has to be searched for the potential presence of snakes prior to use and there should be a brief walkabout prior to commencement of activities to ensure that no snakes or turtles are present in the vicinity of the demolition and construction activities. Also, the contractor shall remove/move, to the greatest extent possible, any debris from the proposed construction zone prior to the spring to prevent snakes from using these items within the construction zone as cover. If any wildlife is discovered that cannot escape quickly enough, then all work in the immediate area will cease until the appropriate DFO staff is consulted.

Barn swallow habitat was identified as the species was observed flying to and from the fascia and soffit of the front façade of the Former Lighthouse Keeper's Dwelling during the May 2018 site visit. They were observed to be nesting on the exterior of the building. However, since project activities are scheduled to take place during the fall and winter seasons (outside of the breading bird season), there is no concern with barn swallow being disturbed during the construction and partial demolition project activities. However, if some project activities were to take place during the spring and early summer, it is recommended that the construction contractor undertake a visual check for nests on the building before any work commences. If nests are detected, they should not be disturbed or removed, and the MNRF would also need to be contacted. See Figure 7-1 for an example of a barn swallow nest. If any wildlife is discovered that cannot escape quickly enough, they should not be handled and all work in the immediate area will cease until the appropriate DFO staff is consulted. The MNRF would need to be contacted upon detection of any SAR by the DFO.

DFO staff should hold a briefing to inform contractors of the potential SAR that may be encountered during the project, as listed in Table 5-1. It is illegal to harass or harm SAR. No SAR are to be handled or moved by contractors. The DFO will inform contractors of the requirements they must undertake should SAR be encountered during the project (e.g. protective measures such as the use of barriers).

Figure 7-1 A Barn Swallow Nest

7.2 Cultural Resources

The exterior of the historic Former Lighthouse Keeper's Dwelling will be kept intact, thus this cultural heritage resource will be protected. Since the proposed construction plan calls for the demolition of the historic Search and Rescue Office, it is recommended that a historical plaque be erected at a suitable prominent location on the former site to commemorate the significance of the demolished structure, or some other method of recognition as directed by FHBRO.

Should human remains be found during construction, all work should be immediately suspended in the vicinity of the discovery. The contactor should notify the Ontario Provincial Police (OPP), or local police, for them to conduct a site investigation and to contact the district coroner. In addition, the St. Catharines office of the Ontario Ministry of Tourism Culture and Sports (MTCS) shall be contacted at 1-800-263-2441.

Should other un-recorded cultural heritage values (archaeological or historical features) be identified during the construction, all work activities shall be suspended in the vicinity of the discovery and Parks Canada Agency (PCA) shall be contacted.

7.3 Hazardous Building Materials and Designated Substances

As the proposed project involves the demolition of the Search and Rescue Office, on-site ancillary structures, such as the Engineer's Office, "Hoop House", "Rope Locker", "Bread Box" (Storage Building), and "Homer Trailer" (Wooden Garden Storage Structure), and at least some renovations to the Former Lighthouse Keeper's Dwelling, it is important that mitigation measures are employed to prevent release of and exposure to hazardous building materials and designated substances. These measures will protect both construction workers and the environment. The following recommendations were taken from the most recent Designated Substances Survey (DSS) completed by DST (2017) and from the most recent Designated Substances and Hazardous Building Materials Assessment on the North Storage Shed (Bread Box) and North Storage Bin (Homer Trailer) completed by Stantec (2018).

Asbestos

The following recommendations apply to asbestos-containing materials (ACMs) and suspected ACMs:

- Appropriate work procedures and precautionary measures must be used, as outlined in O.Reg.278/05, as amended, when performing work that may disturb ACMs or suspected ACMs, including prior to building demolition.
- Disturbance and/or removal of ACMs must be appropriately recorded as part of the building's Asbestos Management Plan.
- If ACMs or suspected ACMs become damaged and worker exposure to the material is likely to occur, the damaged material must be repaired or removed following work procedures outlined in O.Reg. 278/05, as amended.
- Disposal of asbestos waste is controlled by the Ontario *Environmental Protection Act*, Regulation 347/90, General – Waste Management, as amended. This regulation requires that asbestos waste be sealed in double containers resistant to puncture and tears, and appropriately labelled. The waste must be disposed at a licensed waste disposal site. Proper notification must be issued to the site representative prior to transportation of waste. The transport of the waste to the disposal site is controlled by the federal *Transportation of Dangerous Goods Act,* 1992 (TDGA).
- Materials that have not been analyzed but are visibly similar to other materials identified as ACMs, must be considered asbestos-containing unless proven otherwise by laboratory analysis.

Lead

Prior to or during renovation work, the following procedures shall be performed with respect to anticipated lead-containing materials:

- Conduct a risk assessment to assess the potential for exposure to lead to determine the need to follow work procedures such as those published in the Ontario Ministry of Labour (MoL) "*Guideline: Lead on Construction Projects*".

- In the event of conflict between lead precautionary measures and other precautionary measures (e.g. asbestos, silica), the more stringent procedures shall apply.
- The disposal of construction waste containing lead is governed by O.Reg. 347/90 - General – Waste Management, as amended. The transport of the waste to the disposal site is controlled by the federal TDGA. Materials with elevated concentrations of lead should be subject to toxicity characteristic leaching procedure (TCLP) testing to determine toxicity with respect to lead prior to disposal, in accordance with O.Reg. 347/90, as amended.
- Copper piping and cast iron drain pipe joint caulking can be cut a small distance (e.g. 50 mm) from the joints to avoid direct disturbance of the lead material.
- Ceramic tiles can be removed using Type 1 lead precautionary measures, provided select hand tools are used or a power tool equipped with a HEPA vacuum attachment. If these conditions cannot be met, then more stringent procedures are required.
- Emergency light batteries and other batteries shall be removed when decommissioned and disposed of as lead-containing waste.

Mercury

Ontario has no regulations that specifically govern the disturbance of mercury on construction projects. However, the Occupational Health and Safety Division of the Ontario MoL has published "*The Safe Handling of Mercury: A Guide for the Construction Industry*." This document provides advice on how to reduce the risk of mercury exposure, and outlines clean-up methods for spills. This Guide can be utilized in the absence of specific legislation for mercury on construction projects. Following are some specific other recommendations proposed by DST (2017) and Stantec (2018):

- Mercury vapour within light fixtures poses no risk to workers or occupants provided the mercury containers remain intact and undisturbed. Complete removal of mercury-containing equipment is required prior to demolition activities. Prior to demolition work, the light tubes must be removed and disposed of following the requirements of *R.R.O. 1990, Regulation 347 General - Waste Management,* as amended (R.R.O. 1990, Reg. 347) under the EPA.
- The time weighted average exposure limit (TWAEL) for mercury is prescribed by O.Reg. 490/09 Designated Substances, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne mercury levels that exceed this TWAEL.
- Liquid mercury is classified as a hazardous waste under O.Reg. 347/90, as amended. The transport of the waste to a disposal site is controlled by O.Reg. 347/90 and by the federal TDGA. It is now common practice to recycle fluorescent light tubes, and other items containing mercury, recovering the component materials, and avoiding the generation of hazardous waste.

Silica

The Occupational Health and Safety Branch of the Ontario MoL have published "*Guideline: Silica on Construction Projects*". This guideline should be followed during disturbance of silica-containing materials.

Following are key mitigation measures recommended by DST (2017) and Stantec (2018):

- The Guideline: Silica on Construction Projects issued by the MOL, dated April 20111 outlines: legal requirements, health effects, controlling the silica hazard, classification on work and measures, and procedures for working with silica and should be followed during disturbance of silica-containing materials. The Guideline defines the classification of work. It is the classification of the work that determines the appropriate respirators, measures and procedures that should be followed to protect the worker from silica exposure. In the guideline, silica-containing construction operations are classified into three groups, Type 1, Type 2, and Type 3 operations, and can be thought of as being of low, medium, and high risk. From Type 1 to Type 3 operations, the corresponding respirator, and measures and procedures become increasingly stringent.
- Precautions should be taken as required during renovation projects impacting materials expected to contain silica (i.e., coring through concrete slabs, demolition of masonry or concrete units, ceramic tiles, brick, etc.) where dust may be generated. Whenever practical changing how a process is performed to lower the silica exposure is preferable. Wet methods reduce dust and should be used whenever practical, particularly in cutting, grinding, and drilling operations.
- As a general rule, it is preferable to use more stringent dust suppression techniques and engineering controls as opposed to relying on respiratory protection to control worker exposure. Respiratory protection should only be relied on as a last resort when dust suppression techniques and engineering controls fail to control worker exposure.
- The TWAEL for airborne silica is prescribed by O.Reg. 490/09 Designated Substances, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne silica levels that exceed this exposure limit. The regulation provides information on the application of the regulation as well as allowable exposure levels, where the maximum TWA for respirable airborne silica (cristobalite) dust is 0.05 mg/m^3 and 0.01 mg/m^3 for quartz/Tripoli. However, the more stringent level of 0.025 mg/m^3 for respirable crystalline silica (quartz, cristobalite) applies as noted in the ACGIH 2018 TLVs for Chemical Substances and Physical Agents. The assessment and control program and medical surveillance requirements are for non-construction projects as defined in O. Reg. 490/09.

Halocarbons

- When suspected halocarbon-containing equipment is taken out of service, the halocarbon refrigerants must be captured and reclaimed by a licensed technician.
- The presence of halocarbon refrigerants within unit's no longer in service should be verified. If halocarbon refrigerants are found to be present, they must be captured and reclaimed by a licensed technician.
- Appropriate records of equipment decommissioning must be maintained in accordance with requirements of the Federal Halocarbon Regulations, 2003 (FHR).

Should these mitigation measures be implemented, no adverse effects are anticipated from hazardous materials and designated substances.

PCBs

When decommissioned, verify the PCB content of fluorescent lamp ballasts as per the Environment Canada publication Identification of Lamp Ballasts Containing PCBs, 1991. Handle, store and dispose of PCB-containing ballasts in accordance with Federal Regulation SOR/2008-273, under *Canadian Environmental Protection Act* (*CEPA*).

Should a material suspected to contain PCBs become uncovered during demolition activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present. Confirmed PCBs should be handled in accordance with Federal Regulation SOR/2008-273.

7.4 General Effects

Contractors must comply with all federal, provincial, regional, and municipal legislation applicable. Parking and access routes to the work area must only be in DFO designated areas. Vehicles shall be restricted to paved, and/or graveled surfaces, or as directed by DFO officials; and machinery/equipment/materials must be stored at a location approved by the DFO.

In addition to the mitigation measures specified above for the various hazardous building materials and designated substances, the following other general waste management measures are recommended:

- All waste generated shall be disposed in a legal manner according to relevant regulations (such as O. Reg. 347, and as amended).
- Disposal of any hazardous substances shall be conducted in a legal manner according to relevant regulations (such as O. Reg. 347, and as amended).
- The contractor is required to submit proof that a licensed waste hauler is transporting site-generated waste to a facility certified to accept the waste material.
- The contractor is to submit proof that all waste was disposed at a licensed landfill site or waste transfer site. A letter verifying that the proposed landfill site will accept the waste must be supplied to the Project Manager prior to the removal and transport of waste from the site.
- The contractor shall post "No Unauthorized Entry" signs on the exterior of the Site fencing during construction activities and on any applicable areas during the construction phase.

8.0 CUMULATIVE EFFECTS

No cumulative effects are anticipated from the proposed project. All environmental effects, including effects on vegetation, wildlife, noise, potential liquid discharges, dust, etc., are expected to be localized within the immediate construction area, and of limited duration. There are no known other nearby/adjacent projects that are likely to interact cumulatively with the proposed project.

9.0 PUBLIC/STAKEHOLDER ENGAGEMENT AND ABORIGINAL CONSULTATION

9.1 Public/Stakeholder Engagement

Public consultation is not part of the current scope of work and the present PED. However, in light of the location of the proposed project site (remote from residences, commercial and industrial facilities), the limited scope of the project (the demolition of one building and the construction of a new building within an existing property fence), and the overall limited potential for environmental effects, it is anticipated that public interest in this project would be very low.

9.2 Aboriginal Consultation

There is no Aboriginal Reserve or community in close proximity to the subject site. The closest Aboriginal Reserve/community to the subject site is the Six Nations Reserve located approximately 65 km away. Furthermore, as was mentioned above, the project is limited in scope, and no potential effects on Aboriginal communities are anticipated. Therefore, it was determined that Aboriginal consultation is not required.

9.3 Agency Consultation

DFO has consulted with stakeholder agencies, such as FHBRO, regarding the proposed project.

The vast majority of the background environmental information required for completing this PED was provided by DFO and through interviews with Canadian Coast Guard staff, or obtained by Arcadis from other sources such as NHIC. No other agencies were consulted for completing this PED.

10.0 SIGNIFICANCE OF ADVERSE ENVIRONMENTAL EFFECTS

24. Significance of Adverse Environmental Effects:

All identified potential adverse environmental effects associated with the proposed project are expected to be localized and temporary, provided that the mitigation measures outlined in Chapter 7 by Arcadis are implemented.

11.0 MONITORING AND COMPLIANCE REQUIREMENTS UNDER *SPECIES AT RISK ACT*

25. Monitoring and Compliance Requirements under Species at Risk Act:

11.1 Surveillance

Surveillance is required as needed, by qualified DFO staff to monitor the project and ensure that the mitigation measures outlined in this PED are implemented and followed throughout the duration of the proposed project.

11.2 Follow-Up Monitoring

Follow-up monitoring is:

- ☒ not required
- ❑ legally required (e.g. under the *Species at Risk Act* or *Fisheries Act)*
- ❑ required in accordance with the *Parks Canada Cultural Resource Management Policy*

12.0 CONCLUSION

26. Conclusion on Significance of Adverse Environmental Effects:

The project is not likely to cause significant adverse environmental effects; DFO may exercise its power, duty or function, i.e. may issue the authorization.

12.1 Final Report Sign-Off and Approval

27. Prepared by:	**Arcadis Canada Inc.**	**28. Date:**	**31 August 2018**
29. Name:	**Frederick Bernard**		
30. Title:	Principal Environmental Consultant		
31. Approved by:	_____	**32. Date:**	_____
33. Name:	Kevin Bill		
34. Title:	Regional Manager, Federal Infrastructure Initiative		

12.2 Decision

35. Decision Taken

☐ The project is not likely to cause significant adverse environmental effects, and DFO may exercise its power, duty or function.

☐ The project is likely to cause significant adverse environmental effects, and DFO has decided not to exercise its power, duty or function.

☐ The project is likely to cause significant adverse environmental effects, and DFO will ask the Governor in Council to determine if the significant adverse environmental effects are justified in the circumstances.

36. Approved by:	_____	**37. Date:**	_____
38. Name:	Eric Sands		
39. Title:	Regional Director, Real Property, Safety and Security		

40. References: **See Chapter 13.0**

13.0 REFERENCES

40. References:

Aqua Terre Solutions Inc. 2009. *CCME Phase I/II Environmental Site Assessment Search and Rescue Station Port Weller, Ontario, Final Report.* Prepared for Public Works and Government Services Canada, Department of Fisheries and Oceans. File No. 08228d. February.

Bird Studies Canada, Environment Canada's Canadian Wildlife Service, Ontario Nature, Ontario Field Ornithologists and Ontario Ministry of Natural Resources. 2006. Ontario Breeding Bird Atlas Website. http://www.birdsontario.org/atlas/index.jsp

Dobbyn, Jon (Sandy). 1994. Atlas of the Mammals of Ontario. Federation of Ontario Naturalists (Ontario Nature).

DST Consulting Engineers. 2017. Personal Correspondence to Selina Chowdhury, Senior Environmental Specialist, PSPC. Project-Specific Designated Substances Survey – Galley House and Office House Fisheries and Oceans Canada, Port Weller, Ontario. February.

Englobe. 2018. *Update Phase I Environmental Site Assessment Report, 4 Welland Canals Parkway, St. Catharines, Ontario*. Prepared for Public Works and Government Services Canada. March 29.

Government of Canada. 2017. Species at Risk Public Registry: Schedule 1. http://www.registrelep-sararegistry.gc.ca/species/schedules_e.cfm?id=1

Government of Ontario. 2018. Species at Risk in Ontario. Updated: Jan. 30, 2018. http://www.ontario.ca/environment-and-energy/species-risk-ontario-list

Land Information Ontario (LIO). 2018. Make a Natural Heritage Information Map. Updated: February 9, 2018. http://www.ontario.ca/environment-and-energy/make-natural-heritage-area-map

Natural Heritage Information Centre (NHIC). 2017. Get Natural Heritage Information: Species Lists – All Species. http://www.ontario.ca/environment-and-energy/get-natural-heritage-information Accessed: October 31, 2017.

Niagara Peninsula Conservation Authority (NPCA). 2010. Natural Areas Inventory 2006-2010. http://www.npca.ca/watershed-management/natural-areas-inventory/

Ontario's Invading Species Awareness Program (OISAP). 2017. Terrestrial Invasive Plants. http://www.invadingspecies.com/plants/ Accessed: November 3, 2017.

Ontario Nature. 2017. Ontario Reptile and Amphibian Atlas Program. https://ontarionature.org/programs/citizen-science/reptile-amphibian-atlas/ .

Parks Canada. 2018. *Canada's Historic Places: The Canadian Register*. www.historicplaces.ca. Accessed: June 15, 2018.

Pinchin Environmental. 2014. *Hazardous Building Materials Assessment Fisheries and Oceans Canada Port Weller St. Catharines, Ontario.* Prepared for Fisheries and Oceans Canada. April.

Stantec. 2018. *Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station*. Prepared for Public Services and Procurement Canada. July 13.

Taylor Hazell Architects. 2016. *Port Weller Search & Rescue Station Building Condition Report, Investigation and Testing Scope and As Built Drawings.* Prepared for Public Works and Government Services Canada. THA Project No. 1606. August.

Arcadis Canada Inc.

121 Granton Drive, Suite 12

Richmond Hill, ON

Canada, L4B 3N4

Tel 905.764.9380

Fax 905.764.9386

www.arcadis-canada.com

UPDATE PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT

Englobe
Soils Materials Environment

Public Works and Government Services Canada

4 Welland Canals Parkway
St. Catharines, Ontario

Update Phase I Environmental Site Assessment Report

Date: March 29, 2018
Ref. N°: 161-P-0009072-0-01-225-01-SG-R-0001-00

Public Works Government Services Canada

4 Welland Canals Parkway
St. Catharines, Ontario

Update Phase I Environmental Site Assessment Report

Prepared by :

Andrew Dunbrack, P.Eng.
Project Manager

Reviewed by :

Bruce Harper, P.Eng.
Senior Environmental Engineer

EXECUTIVE SUMMARY

Englobe Corp. (Englobe) was retained by Public Works and Government Services Canada (PWGSC), on behalf of Fisheries and Oceans Canada (DFO) to complete an Update Phase I Environmental Site Assessment (ESA) of the property located at 4 Welland Canals Parkway, St. Catharines, Ontario (hereinafter referred to as the "Site").

The Site is an irregular-shaped, approximate 1.2 hectare (ha) property occupied by the Canadian Coast Guard. The Site is currently owned by the St. Lawrence Seaway Management Corporation. The Site is currently developed with seven enclosed structures comprised of the Main building, four storage sheds, a portable office and an Environment Canada Hydrometric Gauging Station. The Main building is utilized for office space (southern portion), minor repair and servicing of general equipment (central portion) and a residence (northern portion) for the Canadian Coast Guard. The storage sheds are utilized for the storage of equipment for search and rescue operations. The portable office is a prefabricated structure supported on a concrete platform, which is used by the Canadian Coast Guard Engineer for general office duties. The Environment Canada Hydrometric Gauging Station is used by Environment Canada staff to obtain data from Lake Ontario. The Site is bordered to the west by Lake Ontario and the east by the Welland Canal water way. The adjoining lands to the north and south are vacant, with a driveway traversing the Site in a north to south direction.

This Phase I ESA was completed in accordance with the Canadian Standards Association (CSA) Standard Z768-01 (R2016). It is Englobe's understanding that this report is being prepared to identify any actual or potential areas of environmental concern since the previous Phase I ESA completed in 2009.

The Phase I ESA includes a review of historical archival information for the Site and surrounding properties, interviews with the Site representative(s) and regulatory personnel, a site reconnaissance, a preliminary Species at Risk assessment, and a final report on the findings of the assessment.

Based on the findings of the Phase I ESA, the following Areas of Potential Environmental Concern (APECs) and Areas of Environmental Concern (AECs) were identified as summarized below.

APEC and AEC Summary Table

APEC # / AEC #	ISSUE / SOURCE	REFERENCE	SUSPECTED OR KNOWN COC	PICTURE NUMBER	RECOMMENDATION	COST ESTIMATE
AEC 1	Issue: Fill material of unknown environmental quality at the Site, including known soil and groundwater impacts at the Site from previous subsurface investigations.	Englobe 2018 Updated Phase I ESA and 2017 Geotechnical Investigation report	Known COCs: Soil: Metals (beryllium, copper, lead and zinc)	N/A	Conduct a Phase II ESA to confirm the extent of the soil and groundwater impacts.	$8,000 to $10,000

APEC # / AEC #	ISSUE / SOURCE	REFERENCE	SUSPECTED OR KNOWN COC	PICTURE NUMBER	RECOMMENDATION	COST ESTIMATE
	Source: The Site was first created by lake filling from the construction of the Welland Canal in the early 1900s.		and/or pH Groundwater: chloride and uranium			
APEC 1	Issue: The current and historic handling and storage of liquids fuels at the Site in six ASTs, including the associated underground piping which extends from the 11,000 L diesel fuel AST to the fuel dispenser located along the eastern portion of the Site. Source: Liquid fuels stored in ASTs.	Englobe 2018 Updated Phase I ESA Site visit	Suspected COCs: PHC F1-F4, BTEX, VOCs and/or Metals	5, 6, 7 and 8	Conduct a Phase II ESA to confirm the current environmental quality of the soil and groundwater in the vicinity of the ASTs and any associated piping.	$30,000 to $40,000

The Statement of Limitations is an integral part of this report and should be considered when reviewing this document and the findings and conclusions contained herein.

TABLE OF CONTENTS

TABLE OF CONTENTS

Tables

TABLE OF CONTENTS

Appendices

Property and Confidentiality

Client:

Public Works and Government Services Canada
4900 Yonge Street
Toronto, Ontario M2N 6A6

REVISION AND PUBLICATION REGISTER		
Revision N°	Date	Modification And/Or Publication Details
0A	2018-02-14	Draft Report Issued
0B	2018-03-21	Revised Draft Report Issued
00	2018-03-29	Final Report Issued

DISTRIBUTION	
1 electronic copy	Client
1 electronic copy	File

ad/jw

1 INTRODUCTION

Englobe Corp. (Englobe) was retained by Public Works and Government Services Canada (PWGSC), on behalf of Fisheries and Oceans Canada (DFO) to complete an Update Phase I Environmental Site Assessment (ESA) of the property located at 4 Welland Canals Parkway, St. Catharines, Ontario (hereinafter referred to as the "Site"). The location of the Site is shown on the attached Location Plan, Drawing 1 contained in Appendix 1.

The Site is an irregular-shaped, approximate 1.2 hectare (ha) property occupied by the Canadian Coast Guard. The Site is currently owned by the St. Lawrence Seaway Management Corporation. The Site is currently developed with seven enclosed structures comprised of the Main building, four storage sheds, a portable office and an Environment Canada Hydrometric Gauging Station. The Main building is utilized for office space (southern portion), minor repair and servicing of general equipment (central portion) and a residence (northern portion) for the Canadian Coast Guard. The storage sheds are utilized for the storage of equipment for search and rescue operations. The portable office is a prefabricated structure supported on a concrete platform, which is used by the Canadian Coast Guard Engineer for general office duties. The Environment Canada Hydrometric Gauging Station is used by Environment Canada staff to obtain data from Lake Ontario.

The Site is bordered to the west by Lake Ontario and the east by the Welland Canal water way. The adjoining lands to the north and south are vacant, with a driveway traversing the Site in a north to south direction. The Site and the surrounding properties are located as shown on the attached Site and Surrounding Land Use Plan, Drawing 2 provided in Appendix 1.

The geo-reference coordinates for the approximate centre of the Site are as follows:

- Universal Transverse Mercator (UTM) coordinates: Zone 17T, 644621 Easting and 4788605 Northing.

Information gathered from discussions, correspondence or telephone interviews during this assessment include the following individuals:

- Mr. Scott Parker, Captain, Canadian Coast Guard (Site representative).
- Ms. Ruchi Chohan, Technical Standards and Safety Authority (TSSA).
- Customer Relations Advisor, Union Gas Ltd.
- Ms. Janet Dadufalza, Freedom of Information (FOI) Manager, Ontario Ministry of the Environment and Climate Change (MOECC).
- Ms. Elizabeth Reimer, Biologist, Ministry of Natural Resources and Forestry (MNRF).

2 SCOPE OF INVESTIGATION

This Phase I ESA was completed in accordance with the Canadian Standards Association (CSA) Standard Z768-01 (R2016). This report was prepared in order to identify any actual or potential areas of environmental concern since the previous Phase I/II ESAs completed in 2009. A Record of Site Condition (RSC) with the Ontario Ministry of the Environment and Climate Change (MOECC) was not required.

This assessment includes a review of historical archival information for the Site and surrounding properties, interviews with the Site representative(s) and regulatory personnel, a site reconnaissance, and a final report on the findings of the assessment. No intrusive investigation or chemical testing (i.e. sampling or testing of air, soil, groundwater, surface water or building materials) was carried out as part of this Phase I ESA.

This Phase I ESA included a preliminary Species at Risk (SAR) assessment, but did not include any other assessment of biological features or related aspects of the natural environment. This assessment did not include a review or audit of operational environmental compliance issues, or of any environmental management systems, which may exist on the Site.

Since neighbouring properties may affect or be affected by the property being assessed, the historical review also included the adjoining sites and surrounding properties within 250 metres (m) from the Site, including the following:

- current and historic land use of the Site and neighbouring properties;
- known or potential contamination on the Site and on neighbouring properties; and,
- Site topography and groundwater flow directions, which may influence the migration of contaminants onto or away from the Site.

The information review of the Site and surrounding properties included the following sources of information:

- interviews/correspondence with the Site representative, and regulatory and municipal personnel;
- a review of environmental source information including relevant MOECC databases;
- commission and review of Environmental Risk Information Services (ERIS) Database Report;
- a review of the Fire Insurance Plans (FIPs) in Ontario Collection document;
- a review of select Vernon's City Directories for St. Catharines; and,
- a review of physical setting sources including aerial photographs, topography, hydrology and geology maps, the presence of fill materials, water bodies and areas of natural significance, and water well records.

A site reconnaissance was completed on December 15, 2017 by Andrew Dunbrack of Englobe, to observe and document the conditions of the Site and surrounding properties including:

- hazardous materials – usage, storage, disposal, treatment, and transport on the Site (if any);
- product handling, raw material storage/transportation, equipment cleaning, etc.;
- storage tanks and containers – above ground and underground tanks and containers;
- water supply – source of potable water;
- stained soil, pavement, concrete, floors and walls;
- general housekeeping;
- sewage disposal – pits, lagoons, septic systems, and wastewater treatment;
- topographic, geological, and hydrogeological features;
- watercourses, ditches, and standing water; and,
- adjacent properties – adjacent land uses that might impact the Site.

Key features of the Site were photographed for future reference and are included with this report as Appendix 2.

3 RECORDS REVIEW

3.1 GENERAL

3.1.1 First Developed Use Determination

Based on the historical records review, the Site was first developed with the construction of the Main building, circa 1931. Based on a review of available aerial photographs, the Site appears to have been vacant land in 1927. According to discussions with the Site representative, the Site was first created by lake filling from the construction of the Welland Canal in the early 1900s.

3.1.2 Fire Insurance Plans and Inspection Reports

Englobe requested copies of available FIPs and other relevant insurance products from Opta Information Intelligence (Opta) through ERIS. Opta provided a written response dated December 12, 2017, which indicated that no FIPs were available for the Site or surrounding area, and that no insurance products were available for the Site. A copy of the Opta response is presented in Appendix 3.

3.1.3 City Directory Information

Englobe contracted ERIS to conduct a search of City of St Catharines Vernon's city directories for selected years to determine past occupancy for the Site. The Site was not listed in the city directories for the years searched (1972, 1977, 1982, 1987, 1992, 1997, 2002, 2007 and 2012). A copy of the City Directory search is presented in Appendix 3.

3.1.4 Previous Reports

Englobe requested copies of all previous environmental reports completed for the Site. Five reports were made available to Englobe for review as summarized as follows.

CCME Phase I/II Environmental Site Assessment, Search and Rescue Station, Port Weller, Ontario, prepared by Aqua Terre Solutions Inc. for Public Works and Government Services Canada and Department of Fisheries and Oceans, dated February 11, 2009.

Three potential environmental concerns were identified for the Site including:

- The presence of six fuel (gasoline, diesel, waste oil and fuel oil) containing above ground storage tanks (ASTs) on Site.
- The environmental quality of the fill material place at the Site was unknown.
- The environmental quality of the sediment adjacent to the Site was unknown.

A follow up Phase II ESA was conducted to investigate the potential environmental concerns, which consisted of the advancement of eight boreholes to approximate depths of 1.2 to 2.1 metres below grade (mbg). Soil samples were collected from the boreholes for laboratory chemical analysis of petroleum hydrocarbon fractions (PHC) F1-F4, benzene, ethylbenzene, toluene and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs). An on-Site potable water well was sampled for inorganics parameters. An attempt was made to sample the sediment in the Welland Canal; however, insufficient amounts of sediments were collected for chemical analysis. Based on the select chemical analysis, the soil samples and potable water sample met the applicable guidelines at that time (CCME Soil Quality Guidelines for the Protection of Environmental and Human Health (Residential/Parkland use in a fine grained soil type) and Canadian Water Quality Guidelines).

Hazardous Building Materials Assessment, Fisheries and Oceans Canada, Port Weller, St. Catharines, Ontario, prepared by Pinchin Environmental Ltd. (Pinchin) for Fisheries and Oceans Canada, dated April 3, 2014.

A hazardous building materials assessment of the Main building was completed, which identified potential hazardous materials consisting of asbestos (exterior caulking), lead (paint, wiring and grounding connectors, solder and batteries in backup generator), mercury (fluorescent lamps),

PCBs (may be present in the light ballast), silica (concrete, mortar, brick, masonry and ceramics) and mould (present in limited areas). It was recommended that this report be provided to the constructor, prior to any renovation/demolition of the Main building.

Project-Specific Designated Substance Survey – Galley House and Office House, Fisheries and Oceans Canada, Port Weller, Ontario, prepared by DST Consulting Engineers Inc. (DST) for Fisheries and Oceans Canada, dated February 13, 2017.

A designated substance and hazardous materials survey of the Main building was completed, which identified designated substances and hazardous building material consisting of asbestos, lead, mercury, silica and halocarbons. It was recommended that each material be managed in accordance with the applicable regulatory body.

Project Effects Determination for Partial Demolition and Addition Project: Port Weller Coast Guard Station DFRP#86422, prepared by DST for PWGSC, dated November 2017.

DST was retained by PWGSC to conduct a Project Effects Determination (PED) for the proposed Port Weller partial demolition and addition project at the Site. Activities includes a Site visit, a review of details of the proposed project and related information and the preparation of a PED in accordance to the Fisheries and Oceans Template. According to this report, the project is not likely to cause significant adverse environmental effects.

Draft Geotechnical Investigation Report, prepared by Englobe Corp. for PWGSC, dated November 8, 2017.

The investigation consisted of the advancement of six boreholes to approximate depths of 2.1 and 6.7 mbg and the instrumentation of one borehole as a monitoring well (BH2). Soil and groundwater were sampled for analysis of PHC F1-F4, volatile organic compound (VOC), PAH and metals and inorganics parameters. Soil analytical results were compared to the Canadian Soil Quality Guidelines (CSQG) for the Protection of Environmental and Human Health and residential land use. Groundwater results were compared to the Health Canada Guidelines for Canadian Drinking Water Quality and the Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life, freshwater marine. Four metals including beryllium, copper, lead and zinc were detected in surface soil sampled at borehole BH2 (0 to 0.6 mbg) at concentrations exceeding the CSQG. Laboratory pH measurements reported for surface soil sampled at boreholes BH2 and BH6 exceeded the upper limit of the CSQG range of 6 to 8. Chloride and uranium were detected in groundwater sampled from monitoring well BH6 at concentrations exceeding the CWQG.

The previous subsurface investigative locations are shown on Drawing 3 in Appendix 1.

3.2 ENVIRONMENTAL SOURCE INFORMATION

A summary of information obtained from interviews with and/or written requests from regulatory agencies is provided hereafter.

- **Ontario Ministry of Environment and Climate Change (MOECC) Freedom of Information (FOI)**: An FOI request was submitted to the MOECC for information related to any environmental concerns, orders, spills, investigations/prosecutions, Waste Generator Numbers/Classes and Certificates of Approvals related to the Site. On January 2, 2018, the MOECC reported that no records were identified for the Site. A copy of this correspondence is included in Appendix 4.
- **City of St. Catharines:** The City of St. Catharines (City) was contacted regarding any records or concerns related to any spills, releases, or environmental violations on the Site. At the time of writing of this report, a response has not been received from the City. Any relevant information which may be received from the City will be forwarded as an addendum to this report.
- **Environmental Risk Information Services Ltd. (ERIS):** A records and regulatory agency database review was completed through a database search carried out by ERIS. The ERIS report includes a review of public and private database records for the Site and surrounding properties within a 250 m study area around the Site boundaries. The report includes a site diagram and a summary, which describe records that relate directly to the Site and records found within the study area.

  The ERIS report was reviewed in its entirety as part of the Phase I ESA information review. A copy of the ERIS report is provided in Appendix 3.

  Based on the ERIS report, thirteen records were identified for the Site as summarized in Table 1 below.

Table 1: Identified ERIS Records – Site

DATABASE	NO. OF RECORDS	RECORD(S) DETAILS	POTENTIAL ENVIRONMENTAL CONCERN
ERIS Historical Searches (EHS)	1	This record is associated with an ERIS historical search for the Site in 2008.	Activities associated with this record are not considered to be a potential environmental concern for the Site.
Contaminated Sites on Federal Land (FCS)	1	The Site status was listed in 2014 as having initial testing completed and no further action required.	Activities associated with this record are not considered to be a potential environmental concern for the Site.
Ontario Regulation 347 Waste Generators Summary (GEN)	11	The Site was listed as a registered waste generator between 1996 to 2011 and 2013 to June of 2017 for the waste streams: oil skimmings and sludges, waste oils and lubricants, and light fuels.	Activities associated with the generation of these wastes are considered to be a potential environmental concern for the Site.

No records were reported for the surrounding properties (within a 250 m radius of the Site).

- **MOECC Inventory of Coal Gasification Plant Waste Sites in Ontario:** A review of the MOECC's Inventory of Coal Gasification Plant Waste Sites in Ontario (April 1987) revealed that the Site has not been used for the gasification of coal. No coal gasification plants were identified within 1 km of the Site.
- **MOECC Inventory of Industrial Site Producing Coal Tars and Related Tars in Ontario:** A review of the MOECC's Inventory of Industrial Sites Producing Coal Tars and Related Tars in Ontario (November 1988) revealed that the production and use of coal or other tars has not taken place at the Site or on the surrounding properties within 1 kilometre (km) of the Site.
- **MOECC Inventory of PCB Storage Sites in Ontario:** The 1997, 1999, and 2003 Inventories of PCB Storage Sites in Ontario indicate that neither the Site nor the surrounding properties within 250 m of the Site have been registered as PCB storage facilities.
- **MOECC Waste Disposal Site Inventory:** The Site is not listed in the MOECC's Waste Disposal Site Inventory (June 1991). No waste disposal sites were located within 2 km of the Site.
- **MOECC Hazardous Waste Information Network (HWIN):** Information contained in the MOECC Hazardous Waste Information Network (HWIN) indicates that the Site (Canadian Coast Guard Search & Rescue) is listed in the MOECC Database as a generator of registered wastes. Information relating to the generation of waste materials at the Site is provided in Table 1 of Section 3.2 above and listed in the ERIS report provided in Appendix 3.
- **MOECC Brownfield Environmental Site Registry:** A review of the MOECC's on-line Record of Site Condition (RSC) database revealed no information relating to environmental investigations or remedial activities for the Site and surrounding properties (within a 250 m radius of the Site).
- **Technical Standards and Safety Authority (TSSA):** The TSSA was contacted for information regarding available records for the Site. The TSSA reported on December 28, 2017 that no records were identified in their database for the Site.
- **Union Gas Service Records:** Union Gas Limited was contacted for information regarding the presence and/or installation date of natural gas at the Site. Union Gas Limited reported on December 19, 2017 that no records were identified for the Site.
- **Ontario Ministry of Natural Resources and Forestry:** The Ontario Ministry of Natural Resources and Forestry (MNRF) was contacted for information regarding Areas of Natural Scientific Interest (ANSIs) and Provincially Significant Wetlands (PSWs) that may be present on the Site or within the surrounding properties. On February 9, 2018, The MNRF responded that no PSWs or ANSIs are present on the Site; however, the Welland Canal Seaway Wetland is located approximately 950 m southeast of the Site. The MNRF identified several species at risk (SAR) for the area; however, no known habitat of any SAR in the study area.

3.3 PHYSICAL SETTING SOURCES

3.3.1 Aerial Photographs

Aerial photographs were reviewed for the years 1927, 1948, 1965, 1988, 2000 and 2015. Copies of the reviewed aerial photographs are presented in Drawings 5 to 9 in Appendix 1, and details related to Site land use are summarized in the table below:

Table 2: Aerial Photographs

DRAWING NO.	YEAR	SCALE	COMMENTS
5	1927	1:5,000	The Site and the surrounding properties to the north and south are part of an earthen structure (i.e. west bank of the Welland Canal) extending out into Lake Ontario.
6	1948	1:7,500	The eastern portion of the Site is developed with a single building/ enclosed structure A north – south driveway traverses the eastern portion of the Site and the canal west bank. The remainder of the Site consists of vegetative cover. With the exception of vegetative cover on the lands to the north and south of the Site, the surrounding properties are generally similar to the 1927 aerial photograph.
7	1965	1:7,500	Several buildings/ enclosed structures appear to have been constructed on the Site; details of which are limited by the scale and clarity of the aerial photograph. The development of the surrounding properties is similar to the 1948 aerial photograph.
8	1988	1:7,500	The development of Site and surrounding properties appear to be similar to the 1965 aerial photograph.
Not proprietary	2000	Variable	The Site appears to be developed with several buildings/ enclosed structures. A driveway traverses the eastern portion of the Site in a north to south direction. A dock and boat launching area are observed on the eastern portion of the Site. The remainder of the Site and surrounding properties are similar to the 1988 aerial photograph.
9	2015	1:7,500	The development of the Site and surrounding properties are similar to the 2000 aerial photograph.

3.3.2 Topography, Hydrology and Geology

Available topographic and geologic maps were reviewed for information on the Site's surface features and the subsurface conditions of the Site and study area.

A 2010 Ontario Base Map (OBM) was reviewed for information on the topographical features and surface development of the Site and surrounding area. The Site is bordered to the east and west by Lake Ontario and the Welland canal, respectively. A roadway traverses the eastern portion of the Site in a north to south direction. Vacant lands are found to the north and south of the Site. Based on the contour lines shown, with the exception of the portions bordering Lake Ontario and Welland Canal, the surfaces of the Site and adjoining properties are characterized by minimal topographical relief. The portion of the OBM depicting the Site and surrounding area is included as Drawing 4 in Appendix 1.

The Site is located within the Physiographic Region of Southern Ontario known as the Iroquois Plain (Chapman and Putnam, 2007). The primary physiographic landforms in the area of the Site are sand plains. Based on quaternary geology mapping, the region is characterized by glaciolacustrine deposits consisting of sand, gravelly sand and gravel (OGS 2010). The region is underlain by shale, limestone, dolostone and siltstone of the Queenston Formation (OGS, 2011).

The localized shallow groundwater flow direction in the general area of the Site is expected to be the west and towards Lake Ontario. However, the groundwater flow direction may be influenced by previously excavated areas and fill materials placed at the Site. An intrusive subsurface investigation(s) would be required to confirm the groundwater direction on the Site.

3.3.3 Fill Materials

According to discussions with the Site representative, the Site was first created by lake filling from the construction of the Welland Canal in the early 1900s. The source location of the fill material is not known. Analysis of soil sampled from two boreholes (BH2 and BH6) advanced as part of the 2017 geotechnical investigation of the Site reported concentrations of four metals parameters (beryllium, copper, lead and zinc) and pH measurements exceeding the Canadian Soil Quality Guidelines (please refer to Section 3.1.4).

The importation of fill material of unknown environmental quality and the analytical results reported for soil sampled at BH2 and BH6 is an AEC at the Site.

3.3.4 Water Bodies and Areas of Natural Significance

The Site is bordered to the east and west by the Welland Canal waterway and Lake Ontario, respectively. During the December 15, 2017 reconnaissance, no other water bodies, streams, ponds, or wetland areas were observed on the Site.

As noted in Section 3.2, the MNRF was contacted for information regarding ANSIs and PSWs that may be present within the surrounding properties. On February 9, 2018, The MNRF responded that no PSWs or ANSIs are present on the Site; however, the Welland Canal Seaway Wetland is located approximately 950 m southeast of the Site.

3.3.5 Well Records

According to ERIS, no water well records were listed for the Site or surrounding properties (within a 250 m radius of the Site). One active potable water supply well was observed at the time of Site visit. The active potable water supply well is utilized for domestic purposes and was located to the southwest of the Main building. The Site representative was not aware of the well construction details.

4 INTERVIEWS

During the December 15, 2017 reconnaissance, Englobe completed an interview with a Site representative. Information gathered from the Site representative, other individuals and/or regulatory agencies have been incorporated into the various sections of this report (both previous and proceeding sections). The information provided by these individuals and regulatory agencies with respect to the current and historical on and off-Site operations and/or occupants are in general agreement with the overall findings of the Phase I ESA information review. A copy of the Phase I ESA questionnaire is provided in Appendix 4.

5 SITE RECONNAISSANCE

5.1 GENERAL REQUIREMENTS

A visual survey of the Site was completed by Andrew Dunbrack of Englobe on December 15, 2017. The assessor's qualifications are provided in Appendix 5. The Site reconnaissance took approximately two hours to complete and the weather conditions were sunny with a temperature of -8°C.

Photographs showing various areas of the Site and surrounding properties with written descriptions for are provided in Appendix 2.

5.2 PHYSICAL IMPEDIMENTS

During the Site visit on December 15, 2017, the ground surfaces were snow covered. Two buildings including Storage Shed #2 and Environment Canada Hydrometric Gauging Station were locked preventing interior access. According to the Site representative, Shed #2 is used for dry storage and the Gauging Station for data collection station, respectively. No other physical impediments were encountered during the Site visit.

5.3 OBSERVATIONS AT THE SITE

The Site is currently developed with seven buildings/enclosed structures consisting of the Main building, four storage sheds, a portable office and an Environment Canada Hydrometric Gauging Station. The Main building is utilized for office space (southern portion), minor repair and servicing of general equipment (central portion) and as a residence (northern portion) for the Canadian Coast Guard. The four storage sheds are utilized for the storage of equipment related to search and rescue operations. The portable office is a prefabricated structure erected over a concrete platform, which is used for the Canadian Coast Guard Engineer for general office duties. The Environment Canada Hydrometric Gauging Station is used by Environment Canada staff to obtain data from Lake Ontario. Access to the Site is provided by a north-south running driveway extending along the east portion of the Welland Canal west jetty. A fence extends along the southern property boundary. A boat launch and dock are located along the eastern portion of the Site.

5.3.1 Site Operations

The Site is occupied by the Canadian Coast Guard as an office/station and residence for workers while on-call for search and rescue activities. The Site is currently developed with seven building structures (Main building, four storage sheds, a portable office and an Environment Canada Hydrometric Gauging Station). The approximate locations of these structures are illustrated on the attached Site Plan, Drawing 3 provided in Appendix 1.

5.3.2 On-Site Buildings

The Site is currently developed with seven building structures as summarized below.

Main building: The Main building was reportedly constructed circa 1931, with an addition (southern portion of the building) completed in 1953. The north portion is of concrete slab-on-grade construction and the south portion is of concrete block basement construction. The building is of wood frame and concrete wall construction and finished with both sloped asphalt shingles and a flat tar and gravel roof. The building is heated by two fuel oil - forced air - furnaces and cooled by two pad mounted air conditioning units.

The Main building is utilized for office space (southern portion), minor repair and servicing of general equipment (central portion) and a residence (northern portion) for the Canadian Coast Guard.

Portable Office: The portable office is a prefabricated structure of metal frame and aluminum siding construction erected on a concrete pad. This small building is utilized for the Canadian Coast Guard Engineer for general office duties.

Storage Sheds: Four on-Site storage sheds constructed on concrete slabs are utilized for the storage of equipment related to search and rescue operations.

Environment Canada Hydrometric Gauging Station: This building is a prefabricated metal structure that was locked at the time of the Site visit. According to the Site representative, the building is locked at all times and is periodically accessed by Environment Canada staff.

5.3.3 Utilities and Mechanical Systems

5.3.3.1 *Wastewater*

Wastewater generated on the Site is limited to the grey water from the sinks and toilets. The waste water is discharged to a septic tank located along the eastern portion of the Main building and is directed to a septic leaching bed located to the north of Storage Shed #1. According to the Site representative, the septic tank is cleaned out on a yearly basis.

5.3.3.2 *Water*

According to the Site representative, the Site is serviced by a potable water well located to the west of the Main building. The Site representative was not aware of the construction details of the potable well. No other domestic water supply wells were observed on the Site during the Site visit.

5.3.3.3 *Stormwater*

Rain water collected on the roof is directed to the ground surface and low lying areas.

5.3.3.4 *Electricity*

The Site is serviced by an overhead hydro line connected to a pole mounted transformer located to the west of the Main building. The transformer is reportedly owned and operated by Horizon Utilities.

5.3.3.5 *Heating and Cooling*

The Main building is heated by means of two oil burning forced air furnaces and supplemented with several electrical base board heaters. Cooling is provided by two pad mounted air conditioning units. The other building/enclosed structures on Site are not heated or cooled.

5.3.3.6 *Hydraulic Equipment*

No hydraulic equipment was observed or reported during the Site visit.

5.3.4 Waste Generation

Solid wastes generated on Site consist of general refuse, which is contained within an exterior luger bin, located on the southern portion of the Site. The contents of the bin are collected and disposed of off-Site on a regular basis.

5.3.5 Aboveground and Underground Storage Tanks

Based on discussions with the Site representative and observations made during the December 2017 reconnaissance, six above ground storage tanks (ASTs) are installed across the Site as summarized in Table 2 below.:

Table 3: On-Site ASTs

TANK	LOCATION	TYPE / MANUFACTURED DATE	TANK STATUS
One - 1,100 L (fuel Oil)	Southwestern exterior wall of the Main building	Steel AST / 2011	At the time of the Site visit, the ASTs were observed to be in good condition and positioned over concrete slabs with no visual evidence of product releases. Due to snow covered surfaces, a visual assessment of evidence of surface staining could not be made.
One - 1,100 L (fuel Oil)	Northwestern exterior wall of the Main building	Steel AST / 2011	
One- 620 L (diesel fuel for backup generator)	Northwestern exterior walls of the Main building	Steel AST / Not listed	
One - 11,000 L (diesel fuel for refueling boats)	North of the Main building	Steel AST, with secondary containment / 1999	
One - 1,900 L (gasoline for refueling boats/equipment)	West of the Storage Shed #1	Steel, double walled / Not listed	
One - 500 L (waste oil)		Steel / 1994	

In addition to the ASTs, a drum containing bilge water was located to the west of the Storage Shed #1, within a plastic secondary containment unit. No other ASTs or visual evidence of USTs were observed on the Site during the Site visit.

Although, the ASTs were observed to be in good condition, with no visual evidence of product releases, the 11,000 L diesel fuel AST has piping which extends underground to a fuel dispenser located on the eastern portion (shoreline) of the Site. No groundwater sampling and analysis has been completed in the close proximity of the ASTs. Therefore, the current and historical handling and storage of liquid fuels in ASTs is considered to be an APEC for the Site.

5.3.6 Floor Drains and Oil/Water Separator

Based on discussions with the Site representative, the Site does not operate an oil/water separator. No floor drains were observed or reported to Englobe in the building structures on Site.

5.3.7 Chemical Storage and Handling

5.3.7.1 *Storage of Products and Wastes*

Based on discussions with the Site representative and observations made during the December 2017 reconnaissance, six ASTs used for either fuel or waste liquid storage are found on Site (see Section 5.3.5). Several other small quantities of liquids (paints, lubricating oils, greases, etc.) are stored within hazardous storage lockers located within Storage Sheds #1, #3 and #4.

5.3.7.2 *Compressed Gas Storage*

Compressed gases, (propane tanks) are stored within a steel cage located along the northwestern exterior of the Storage Shed #1.

5.3.7.3 *Unidentified Substances*

Englobe did not observe any unidentified substances at the time of the December 2017 Site reconnaissance.

5.3.8 Spills and Staining

The Site representative reported that no significant spills or releases have occurred at the Site. At the time of the Site visit, the concrete surfaces beneath the ASTs appeared to be in good condition; however, it should be noted that the ground surface was snow covered.

5.3.9 Railway Lines

No rail spurs were observed on Site or on the surrounding properties.

5.3.10 Air Emissions

During the Site visit, Englobe observed two fuel oil burning furnaces and one diesel fueled back-up generator. No other sources of air emissions were observed by Englobe during the Site visit.

5.3.11 Hazardous Materials

5.3.11.1 *Asbestos-Containing Materials (ACMs)*

In 1973, the Ontario Construction Safety Act was amended to prohibit the spray application of asbestos. Shortly thereafter, major suppliers of pipe and boiler insulation ceased using asbestos-containing materials ("ACMs"). The occurrence of asbestos in building construction materials is not uncommon in buildings constructed pre-1990. Regulation 278 of the Ontario Occupational Health and Safety Act outlines the need for an owner/manager of a building to determine whether ACMs exist in the building, and the need to repair or remove damaged ACMs and to maintain such ACMs if left in place.

The potential presence of ACM at the Site was evaluated through discussions with Site representative and visual observations. No intrusive investigations were conducted to examine areas of concealed space for the presence of ACM. Based on the age of the buildings, potential ACM could be present in building materials such as dry wall, caulking, roofing materials, etc. According to previous environmental reports completed at the Site (refer to Section 3.1.4), ACM has been identified at the Site.

5.3.11.2 *Polychlorinated Biphenyls (PCBs)*

The use of PCBs in electrical equipment, such as transformers and capacitors (including capacitors found in fluorescent lamp ballasts), was common up to 1980. Ontario Regulation 362 under the Environmental Protection Act (R.S.O. 1990) prohibits the use of PCBs in electrical equipment installed after July 1, 1980.

As of September 5, 2008, under Subsection 93(1) of the Canadian Environmental Protection Act (CEPA, 1999), new Federal PCBs regulations have been published by the Canada Gazette Part II (SOR/SOR/2008-273) that impose specific deadlines for the elimination of all PCBs in concentrations at or above 50 mg/kg. The new regulation requires the elimination of all PCBs and PCB-containing materials currently in storage and limits the period of time PCB-containing materials can be stored before being eliminated. Other aspects of the new regulation govern the labelling and reporting of stored PCB-containing materials and equipment, as well as improved practices for the management of PCBs that remain in use (i.e. those with PCB concentrations less than 50 mg/kg) until their eventual elimination.

Fluorescent lamps were observed in the Site buildings and a pole mounted transformer located to the west of the Main building may be charged with PCB containing liquids. The Site representative was not aware of any PCB containing equipment at the Site.

5.3.11.3 *Lead-Based Materials*

In 1976, the lead content in interior paint was limited to 0.5% by weight under the federal Hazardous Products Act. Lead-based water supply pipes were in use up until the approximate mid-1900s. Between 1930 and 1986, most buildings used copper pipe with lead-solder joints. Other lead-based products include wall shielding (X-ray rooms).

According to the Pinchin (2014) environmental report (See Section 3.1.4) lead was identified in building materials (paint, wiring and grounding connectors, solder and batteries in backup generator) at the Site.

5.3.11.4 *Urea Formaldehyde Foam Insulation (UFFI)*

UFFI was used as an insulation product for existing residential houses between the mid-1970s and 1980, the year it was banned in Canada. It was not commonly used for commercial or industrial buildings.

No evidence of the application of UFFI to the Site building was observed during the Site visit.

5.3.11.5 *Ozone-Depleting Substances (ODSs)*

Ozone depleting substances ("ODSs") include chemicals containing chlorofluorocarbon ("CFC"), hydrochlorofluorocarbon ("HCFC"), halon or any other material capable of destroying ozone in the atmosphere. Historically, ODSs have been used in many products, including: rigid polyurethane foam and insulation, laminates, aerosols, refrigerants, fire extinguishers and cleaning solvents. Federal regulations require the complete elimination of HCFC-22 (Freon 22) by the year 2020. Refrigerants containing CFCs, hydrochlorofluorocarbons and hydrofluorocarbons, are regulated in Ontario by the Refrigerants Regulation (Ontario Regulation 189/94) under the Environmental Protection Act. CFCs should be contained and not released into the environment.

Potential sources of ODSs at the Site are likely limited to small quantities of refrigerant in the air conditioning units.

5.3.12 Special Attention Items

5.3.12.1 *Radon Gas*

Radon is a naturally occurring gas produced by the decay of Uranium-238 that is commonly found in geological formations of granite, sandstone, coal, phosphate and uranium deposits. Radon is colourless, odourless and tasteless and may percolate up through soil and accumulate in basements of buildings through foundation cracks and joints. Because the generation of radon is dependent upon regional geological factors, it is generally not a site-specific concern. The Ontario Building Code identifies these areas of Ontario (Elliot Lake, Township of Faraday in Hastings County, Township of Hyman in Sudbury District) where special measures must be taken with regards to allowable concentrations of radon gas. Englobe is not aware of any official standard for radon concentrations in soil gas in Ontario.

Based on the geology of the area, radon gas accumulation is not expected to be a significant environmental concern at the Site. However, no radon gas testing was carried out during this assessment.

5.3.12.2 *Microbial Contamination (Mould) and Indoor Air Quality*

The growth of mould in indoor environments can produce adverse health effects and is typically due to a moisture problem related to building envelope or mechanical systems deficiencies or design. There is no practical way to eliminate all mould and mould spores in the indoor environment. The way to control mould is to control moisture.

No significant visual or olfactory evidence of the presence of mould was identified during the Site visit.

5.3.12.3 *Electromagnetic Frequencies (EMFs)*

Electrical currents induce electromagnetic fields. No scientific data supports definitive answers to questions about the existence or non-existence of health risks related to electromagnetic fields.

No high-voltage transmission lines or electrical substations, which could generate significant electromagnetic fields, were identified on or adjacent to the Site. No EMF testing was carried out as part of this assessment.

5.3.12.4 *Noise and Vibration*

The effects of noise and vibration on human health vary according to the susceptibility of the individual exposed, the nature of the noise/vibration and whether exposure occurs in the working environment or in the home.

With the exception of the nearby seaway traffic through the Welland Canal, no other sources of excessive noise and/or vibration were identified on the Site or on adjoining or nearby properties during the Site visit.

5.4 OBSERVATIONS AT SURROUNDING PROPERTIES

The neighbouring properties surrounding the Site were observed during the December 2017 reconnaissance from accessible public locations. The historical land use at these adjacent and nearby properties was assessed based on information obtained from aerial photographs, interviews, city directories, and the ERIS public and private database search.

Table 4: Surrounding Properties

POSITION RELATIVE TO SITE	PROPERTY DESCRIPTION	POTENTIAL FOR CONTAMINATION
North	Vacant land.	These properties are not considered to be a potential environmental concern for the Site.
East	Welland Canal waterway.	
South	Vacant Land.	
West	Lake Ontario.	

6 SPECIES AT RISK ASSESSMENT

A Species at Risk (SAR) assessment was completed for the Site to determine the potential for SAR occurrences and/or SAR habitat at the Site.

6.1 SITE VISIT

An SAR assessment was conducted during the Site visit on December 15, 2017. Species at Risk habitat preferences were compared to current conditions observed at the Site. Photographs were taken from the Site for referencing purposes and are included in Appendix 2.

At the time of the Site visit, the Site was developed with seven buildings/ enclosed structures (Main building and four storage sheds a portable office and an Environment Canada Hydrometric Gauging Station). Access to the Site is provided by a north –south running driveway extending along the east portion of the Welland Canal west jetty. A fence extends along the southern property boundary. A boat launch and dock are located along the eastern portion of the Site. The ground surface at the Site is primarily vegetative growth (grass) with sporadic trees. The Site has a slight embankment along the eastern and western portions of the Site toward Lake Ontario and the Welland Canal waterway, which could serve as a wildlife habitat.

6.2 SPECIES AT RISK

To determine the presence of SAR on Site, Environment Canada's SAR database, Ontario Ministry of Natural Resources and Forestry (MNRF) Natural Heritage Information Centre (NHIC), the MNRF Species at Risk by Area Tool, and the Conservation Ontario Aquatic Species at Risk Maps, were reviewed for federally and provincially listed species whose distribution ranges overlap the Site.

In addition, email inquiries were sent to Environment Canada (Canada Wildlife Service), Ontario MNRF, Department of Fisheries and Oceans Canada (DOF), and the Niagara Peninsula Conservation Authority (NPCA) for additional information on SAR in the area of the Site. This information is included in the correspondence in Appendix 4.

A total of seventy-eight (78) species were identified as having ranges encompassing the Site, identified in Table 5 below. As summarized in Table 5, apart from two bird, two insect, six plant and one snake specie which rate medium, the habitat potential of the Site rates no or low. It is further noted that the Site consists of lands reclaimed from Lake Ontario and does not represent natural habitat for any of the SAR. The surrounding waters of Ontario are potential source of habitat for aquatic species and aquatic birds, mammals and insects.

Table 5: Species at Risk Summary

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
Amphibians	Allegheny Mountain Dusky Salamander *(Desmognathus ochrophaeus)*	Schedule 1, Threatened	Threatened	Endangered	Allegheny Mountain Dusky Salamanders are found most often in or near forested small streams, springs, or seeps (areas where water in the ground oozes to the surface to form a pool). They typically nest in underground cavities close to seeps, or in shallow depressions in moist soil beneath logs, stones, moss, leaf litter, or stumps. They are usually absent from larger streams.	Low	Low
	Fowler's Toad *(Anaxyrus fowleri)*	Schedule 1, Endangered	Endangered	Endangered	In Ontario, Fowler's Toads inhabit open beaches, dunes, sandy shorelines, rocky pools, creek and stream mouths, backshore wetlands, and marshes along the northern shore of Lake Erie.	Low	Low
	Jefferson Salamander *(Ambystoma jeffersonianum)*	Schedule 1, Endangered	Endangered	Endangered	Jefferson Salamanders live in moist, loose soil, under logs or in leaf. In the spring, they travel to woodland ponds to breed where they lay their eggs in clumps attached to underwater vegetation. By midsummer, the larvae lose their gills and leave the pond and head into the surrounding forest. In the forests, Jefferson Salamanders spend much of their time underground in rodent burrows, and under rocks and stumps.	Low	Low
	Northern Dusky Salamander (Desmognathus fuscus)	Schedule 1, Endangered	Endangered	Endangered	Northern dusky salamanders are mainly found on land, but are always close to small groundwater fed streams, seeps, and springs, where they live under rocks, logs, or leaf litter within or near water.	Low	Low
	Acadian Flycatcher (Empidonax virescens)	Schedule 1, Endangered	Endangered	Endangered	Acadian Flycatchers are typically found in mature, shady forests with ravines, or in forested swamps with lots of maple and beech trees. The nest is placed near the tip of a lower limb on a tree, and is loosely woven, with strands of plant material hanging down. In Ontario, they are mostly found in large forests and forested ravines.	Low	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
Birds	Bald Eagle (Haliaeetus leucocephalus)	No Schedule, No Status	Not at Risk	Special Concern	Bald Eagles nest in a variety of habitats and forest types, almost always near a major lake or river where they do most of their hunting. They usually nest in large trees such as pine and poplar. During the winter, Bald Eagles sometimes congregate near open water, or in places with a high deer population where carcasses might be found.	Low	Low
	Barn swallow (Hirundo rustica)	No Schedule, No Status	Threatened	Threatened	Barn Swallows often live in close association with humans, building their cup-shaped mud nests almost exclusively on human-made structures such as open barns, under bridges and in culverts. The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood, since the mud does not adhere as well to smooth surfaces.	Medium	Medium
	Bank Swallow (Riparia riparia)	Schedule 1, Threatened	Threatened	Threatened	Bank swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of river and lakes, or found in active sand and gravel pits, or former pits where the banks remain suitable. Bank swallows breeding sites are often situated near open terrestrial habitat used for aerial foraging (i.e., grasslands, meadows, pastures, and agricultural cropland).	Medium	Medium
	Black Tern (Chlidonias niger)	No Schedule, No Status	Not at Risk	Special Concern	Shallow marshes, especially in cattails to build floating nests in loose colonies; breeds in the temperate regions of Ontario, mainly in the marshes surrounding the Great Lakes.	No	Low
	Bobolink *(Dolichonyx oryzivorus)*	No Schedule, No Status	Threatened	Threatened	Large, open expansive grasslands with dense ground cover; hayfields, meadows or fallow fields; marshes; requires tracts of grassland >50 ha in area.	No	Low
	Chimney Swift *(Chaetura pelagica)*	Schedule 1, Threatened	Threatened	Threatened	This species is more likely to be found in and around urban settlements where they nest and roost (rest or sleep) in chimneys and other manmade structures. They also tend to stay close to water as this is where the flying insects they eat congregate.	Low	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Common Nighthawk *(Chordeiles minor)*	Schedule 1, Threatened	Threatened	Special Concern	The Common Nighthawk habitat consists of open areas with little to no ground vegetation, such as logged or burned-over areas, forest clearings, rock barrens, peat bogs, lakeshore, and mine tailings. Common Nighthawks tend to occupy natural sites, they have also been found to nest in cultivated fields, urban parks, orchards, mine tailings, and along gravel roads and railways.	Low	Low
	Eastern Meadowlark *(Sturnella magna)*	No Schedule, No Status	Threatened	Threatened	Grassland habitats, including native prairies and savannahs, as well as non-native pastures, hayfields, weedy meadows, herbaceous fencerows and airfields.	Low	Low
	Eastern Whip-poor-will *(Antrostomus vociferus)*	Schedule 1, Threatened	Threatened	Threatened	The Eastern Whip-poor-will is usually found in areas with a mix of open and forested areas, such as savannahs, open woodlands, or openings in more mature, deciduous, coniferous, and mixed forests. It forages in these open areas and uses forested areas for roosting and nesting. Individuals will often feed in nearby shrubby pastures or wetlands with perches.	No	Low
	Eastern Wood-pewee *(Contopus virens)*	Schedule 1, Special Concern	Special Concern	Special Concern	Eastern Wood-pewees live in the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in intermediate-age mature forest stands with little understory vegetation.	No	Low
	Golden-winged Warbler *(Vermivora chrysoptera)*	Schedule 1, Threatened	Special Concern	Special Concern	Golden-winged warblers prefer to nest in areas with young shrubs surrounded by mature forest; areas that have recently been disturbed, such as field edges, hydro or utility right-of-way's, or logged areas.	No	Low
	Northern Bobwhite *(Colinus virginianus)*	Schedule 1, Endangered	Endangered	Endangered	Northern bobwhites live in savannahs, grasslands, around abandoned farm fields, along brushy fencerows and other similar sites. They particularly like to live in grasslands that are occasionally burned because the fires help keep the habitat from becoming too forested, so the bobwhites can find most of their yearly needs.	No	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Henslow's Sparrow *(Ammodramus henslowii)*	Schedule 1, Endangered	Endangered	Endangered	Open fields, which include tall grasses, interspersed with tall herbaceous plants, or shrubby species; avoids grazed or burned areas; prefers undisturbed areas with dense living grasses and dense thatch of dead grasses; may occupy hayfields, but if hay is cut early, nests are destroyed; only areas that remain undisturbed for several years appear to be more successfully colonized.	No	Low
	King Rail *(Rallus elegans)*	Schedule 1, Endangered	Endangered	Endangered	King rails are found in densely vegetated freshwater marshes with open shallow water that merges with shrubby areas. They are sometimes found in smaller isolated marshes but most seem to prefer larger, coastal wetlands. They nest just above the water in shrubs or clumps of other marsh plants.	Low	Low
	Least Bittern *(Ixobrychus exilis)*	Schedule 1, Threatened	Threatened	Threatened	In Ontario, the Least bittern is found in a variety of wetland habitats, but strongly prefers cattail marshes with a mix of open pools and channels. This bird builds its nest above the marsh water in stands of dense vegetation, hidden among the cattails. The nests are almost always built near open water, which is needed for foraging. This species eats mostly frogs, small fish, and aquatic insects.	No	Low
	Louisiana Waterthrush *(Parkesia motacilla)*	Schedule 1, Special Concern	Threatened	Threatened	The Louisiana Waterthrush is usually found in steep, forested ravines with fast-flowing streams. Although it prefers running water, especially clear, coldwater streams, it also less frequently inhabits heavily wooded, deciduous swamps having large pools of open water. It nests among roots of fallen trees, in niches of stream banks, and in or under messy logs.	No	Medium
	Piping Plover *(Charadrius melodus)*	Schedule 1, Endangered	Endangered	Endangered	Piping Plovers nest exclusively on dry sand or gravelly beaches just above the reach of high water and waves. The birds spend virtually all of their time between the water's edge and the back of the beach when they are not migrating.	Low	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Red-headed Woodpecker *(Melanerpes erythrocephalus)*	Schedule 1, Threatened	Threatened	Special Concern	The Red-headed Woodpecker lives in open woodland and woodland edges including oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, road sides, urban parks, golf courses, and cemeteries. These areas typically have many dead trees which the birds use for nesting and perching.	Low	Medium
	Peregrine Falcon *(Falco peregrinus)*	Schedule 1, Special Concern	Special Concern	Special Concern	Peregrine Falcons usually nest on tall, steep cliff ledges close to large bodies of water, but on occasion have been found nesting in trees, on flat ground, or on the tops or ledges of buildings. In migration and winter you can find Peregrine Falcons in nearly any open habitat, likely along barrier islands, mudflats, coastlines, lake edges, and mountain chains.	Low	Low
Birds	Wood Thrush (Hylocichla mustelina)	Schedule 1, Threatened	Threatened	Special Concern	The wood thrush lives in mature deciduous and mixed (conifer-deciduous) forests. They seek moist stands of trees with well-developed undergrowth and tall trees for singing perches. They prefer large forests, but will also use smaller stands of trees. They build their nests in living saplings, trees, or shrubs, usually in sugar maple or American beech.	Low	Medium
	Prothonotary Warbler *(Protonotaria citrea)*	Schedule 1, Endangered	Endangered	Endangered	The Prothonotary warbler nests in small, shallow holes, found low in the trunks of dead or dying trees standing in or near flooded woodlands or swamps. They nest in tree cavities, where it typically lays four to six eggs on a cushion of moss, leaves, or plant fibres. Silver maple, ash, and yellow birch are common trees in these habitats.	Low	Low
	Yellow-breasted Chat *(Icteria virens)*	Schedule 1, Endangered	Endangered	Endangered	The yellow- breasted chat lives in thickets and scrub where dense shrubby growth is common, especially locations where clearings have become overgrown. Its habitat often consists of abandoned farmland and other rural areas where overgrown vegetation proliferates.	Low	Medium
Fish and Mussels	Lake Sturgeon *(Acipenser fulvescens)*	No Schedule, No Status	Threatened	Threatened	Bottom-dwelling fish found in large rivers and lakes, at depths generally between 5 and 10 m, sometimes greater; spawns in spring in fast-flowing water at depths between 0.6 and 5 m over hard-pan clay, sand, gravel and boulders	No	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	American Eel *(Anguilla rostrate)*	No Schedule, No Status	Threatened	Endangered	American Eel is found in all freshwater, estuaries, and coastal marine waters that are accessible to the Atlantic Ocean, from Niagara Falls up to the mid-Labrador coast.	No	Medium
	Eastern Pondmussel *(Ligumia nasuta)*	Schedule 1, Special Concern	Special Concern	Endangered	The Eastern Pondmussel is typically found in sheltered areas of lakes and in slow-moving streams and rivers in substrates of fine sand and mud.	No	Medium
	Kidneyshell *(Ptychobranchus fasciolaris)*	Schedule 1, Endangered	Endangered	Endangered	The Kidneyshell is typically found in small to medium sized rivers with shallow, clear, swift-moving water and substrates of firmly packed coarse sand and gravel.	No	Low
	Lake Chubsucker *(Erimyzon sucetta)*	Schedule 1, Endangered	Endangered	Threatened	The Lake Chubsucker lives in marshes and lakes with clear, still, warmer water and plenty of aquatic plants. This habitat is found in bays, channels, ponds, or coastal wetlands. During the breeding season (April to early June), adults move into marshes where eggs are laid among vegetation in shallow water.	No	Medium
	Redside Dace *(Clinostomus elongates)*	Schedule 1, Endangered	Endangered	Endangered	The Redside Dace is found in pools and slow-moving areas of small streams and headwaters with a gravel bottom. They are generally found in areas with overhanging grasses and shrubs. During spawning they can be found in shallow parts of streams.	No	Low
	Round Pigtoe *(Pleurobema sintoxia)*	Schedule 1, Endangered	Endangered	Endangered	The Round Pigtoe is usually found in rivers of various sizes with deep water and sandy, rocky, or mud bottoms.	No	Medium
	Snuffbox *(Epioblasma triquetra)*	Schedule 1, Endangered	Endangered	Endangered	The Snuffbox is typically found in small to medium-sized rivers in shallow riffle areas. They prefer clean, clear, swift-flowing water and firm rocky, gravel, or sand river bottoms.	No	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Northern Brook Lamprey *(Ichthyomyzon fossor)*	Schedule 1, Special Concern	Special Concern	Special Concern	The Northern Brook Lamprey inhabits clear, coolwater streams. The larval stage requires soft substrates such as silt and sand for burrowing which are often found in the slow-moving portions of a stream. Adults are found in areas associated with spawning, including fast flowing riffles comprised of rock or gravel.	No	Low
Insects	Rusty-patched Bumble Bee *(Bombus affinis)*	Schedule 1, Endangered	Endangered	Endangered	Rusty-patched Bumble Bees can be found in open habitats such as mixed farmland, urban settings, savannah, open woods, and sand dunes. They are often found in oak savannah, which contains both woodland and grassland flora and fauna.	Medium	Medium
	Monarch *(Danaus plexippus)*	Schedule 1, Special Concern	Endangered	Special Concern	Monarchs typically use three different types of habitat. The caterpillars feed on milkweed plants and are confined to meadows and open areas where milkweed grows such as roadsides, fields, wetlands, prairies, and open forests. Adult Monarchs can be found in more diverse habitats where they feed on nectar from a variety of wildflowers.	Low	Low
	West Virginia White *(Pieris virginiensis)*	Not Listed	Not Listed	Special Concern	The West Virginia White lives in moist, deciduous woodlots. This butterfly requires a supply of toothwort, a small, spring-blooming plant that is a member of the mustard family, since it is the only food source for larvae.	Medium	Medium
Mammals	Woodland Vole *(Microtus pinetorum)*	Schedule 1, Special Concern	Special Concern	Special Concern	The Woodland Vole is commonly associated with deciduous forests, but also inhabits scrubby sand dunes, swamps, and orchards. They are influenced by the amount and type of cover, soil moisture and soil type, preferring areas with dense herbaceous vegetation and friable soils with low saturation.	No	Low
	Eastern Small-footed Bat *(Myotis leibii)*	Not Listed	Not Listed	Endangered	In the spring and summer, eastern small-footed bats will roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees. In the winter, these bats hibernate, most often in cold, dry caves and abandoned mines.	Low	Medium

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Little Brown Bat *(Myotis lucifugus)*	Schedule 1, Endangered	Endangered	Endangered	Little brown bats roost in trees, buildings, caves, rocks, and wood piles during the day, often selecting attics, abandoned buildings and barns for summer colonies. Little brown bats hibernate from October or November to March or April, most often in caves or abandoned mines.	Low	Low
	Northern Myotis *(Myotis septentrionalis)*	Schedule 1, Endangered	Endangered	Endangered	Northern myotis are associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. These bats hibernate from October/November to March/April, most often in caves or abandoned mines.	No	Low
	Tri-colored Bat *(Perimyotis subflavus)*	Schedule 1, Endangered	Endangered	Endangered	Tri-colored bats are found in a variety of forested habitats in the summer, often forms day roosts and maternity colonies in older forests and occasionally in barns or other structures. They forage over water and along streams in the forest. In the winter they generally swarm near caves or underground locations where they stay overwinter.	Low	Medium
Plants and Lichens	American Ginseng *(Panax quinquefolius)*	Schedule 1, Endangered	Endangered	Endangered	American ginseng typically grows in rich, moist, but well-drained, and relatively mature deciduous woods dominated by Sugar Maple, White Ash, and American Basswood. It usually grows in deep, nutrient rich soil over limestone or marble bedrock.	No	Low
	Butternut *(Juglans cinerea)*	Schedule 1, Endangered	Endangered	Endangered	Butternut is mainly encountered as a minor component of deciduous stands, but large pure populations exist on certain flood plains. It grows best in rich, moist, and well-drained soils often found along streams. It may also be found on well-drained gravel sites, especially those made up of limestone. It is also found, though seldom, on dry, rocky and sterile soils.	Medium	Medium
	American Chestnut *(Castanea dentate)*	Schedule 1, Endangered	Endangered	Endangered	The American Chestnut prefers dryer upland deciduous forests with sandy, acidic to neutral soils. The species grows alongside Red Oak, Black Cherry, Sugar Maple, American Beech and other deciduous tree species.	No	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	American Columbo *(Frasera caroliniensis)*	Schedule 1, Endangered	Endangered	Endangered	American Columbo grows primarily in open deciduous forests, and to a lesser extent along open forest edges and dense shrub thickets. It is most commonly found in dry upland forests, but in parts of its range it has been found in grasslands, moist woods, and swampy habitats.	Medium	Medium
	American Water-willow *(Justicia americana)*	Schedule 1, Threatened	Threatened	Threatened	The American Water-willow grows along the shores and in the waters of streams, rivers, lakes, ditches, and occasionally wetlands. It can grow on wet soil and in up to 1.2 metres of water, but appears to require periodic flooding and wave action to reduce competition from other plants. The underlying subsoil on which it grows is usually gravel, sand, or organic matter.	Low	Low
	Broad Beech Fern *(Phegopteris hexagonoptera)*	Schedule 3, Special Concern	Special Concern	Special Concern	The Broad Beech Fern prefers to grow in rich soils in deciduous forests, often in areas dominated by maple and beech trees. It requires moist soil and usually grows in full shade.	No	Low
	Cherry Birch *(Betula lenta)*	Schedule 1, Endangered	Endangered	Endangered	The Cherry Birch is found on moist, well-drained clay loam soil over limestone bedrock, but it may also be found on coarse-textured or rocky shallow soils. In Ontario, it occurs with Eastern Hemlock and various upland hardwoods, such as White Oak, Red Oak, Sugar Maple.	No	Low
	Common Hoptree *(Ptelea trifoliate)*	Schedule 1, Threatened	Special Concern	Special Concern	The Common Hoptree is found often along shorelines in areas of nutrient poor sandy soils, although it is sometimes found on thin soils overlying limestone. It does best I full sun and is intolerant of shade.	No	Low
	Cucumber Tree (Magnolia acuminate)	Schedule 1, Endangered	Endangered	Endangered	The Cucumber Tree requires rich, moist, medium- to coarse-textured acidic soil. The species is shade-tolerant and hence requires forest with openings, such as wet woods with scattered pools. Regeneration will only occur under good light conditions.	Medium	Medium

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Deerberry *(Vaccinium stamineum)*	Schedule 1, Threatened	Threatened	Threatened	Deerberry is found in habitats where the climate is moderated by their proximity to large bodies of water. In Ontario, Deerberry is found predominately in dry open woods on sandy and well-drained soils growing under oaks, Pitch Pine, or White Pine.	No	Low
	Drooping Trillium *(Trillium flexipes)*	Schedule 1, Endangered	Endangered	Endangered	Drooping trillium is typically found in hardwood forests on mesic, circumneutral soils. Canadian populations are associated with watercourses, usually on better drained microsites on floodplain terraces or adjacent slopes with sandy loam soils.	Medium	Medium
	Dwarf Hackberry *(Celtis tenuifolia)*	Schedule 1, Threatened	Threatened	Threatened	Dwarf Hackberry grows in several different habitats, including dry, sandy areas near lakeshores, inland dunes, ridge tops, and limestone alvars. Dwarf Hackberry is a sun-loving tree that does best in areas where it will not be shaded-out by other trees and vegetation.	No	Low
	Eastern Flowering Dogwood *(Cornus florida)*	Schedule 1, Endangered	Endangered	Endangered	Eastern Flowering Dogwood grows under taller trees in mid-age to mature deciduous or mixed forests. It most commonly grows on floodplains, slopes, bluffs, and in ravines, and is also sometimes found along roadsides and fencerows.	No	Low
	Green Dragon *(Arisaema dracontium)*	Schedule 3, Special Concern	Special Concern	Special Concern	The Green Dragon grows in somewhat wet to wet deciduous forests along streams, particularly maple forest and forest dominated by Red Ash and White Elm trees.	No	Low
	Red Mulberry *(Morus rubra)*	Schedule 1, Endangered	Endangered	Endangered	Red Mulberry grows in moist, forests habitats and on both sandy and limestone-based loamy soils. It is often found in areas where the forest canopy is quit open and allows lots of sunlight to read the forest floor, but it will tolerate some shade.	Medium	Medium

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Round-leaved Greenbrier *(Smilax rotundifolia)*	Schedule 1, Threatened	Threatened	Threatened	Round-leaved Greenbrier prefers open moist to wet woodlands, often growing on sandy soils.	No	Low
	Shumard Oak*(Quercus shumardii)*	Schedule 3, Special Concern	Special Concern	Special Concern	Shumard Oak prefers moist soils, and can grow close to water and in swampy areas. It typically grows in deciduous forests or along fencerows.	Medium	Medium
	Spoon-leaved Moss *(Bryoandersonia illecebra)*	Schedule 1, Endangered	Threatened	Endangered	Spoon-leaved moss grows in a range of habitat types but most Canadian populations are located on soil in low-lying areas that are seasonally flooded under trees or shrub thickets. It is often found in close proximity to narrow-leaved wetland plume moss, which is associated with swamps, marshes, and wet meadows.	No	Low
	Spotted Wintergreen (Chimaphila maculate)	Schedule 1, Endangered	Threatened	Endangered	Spotted wintergreen occurs in semi-open dry oak-pine woodland habitats with sandy soils. The plant tends to occur on well-drained sandy soils free of coarse fragments, with low organic content and poor nutrient status. Typically, dominant tree species include White Pine, Red Oak, Black Oak, and American Beech.	No	Low
	Swamp Rose-mallow *(Hibiscus moscheutos)*	Schedule 1, Special Concern	Special Concern	Special Concern	Swamp rose –mallow is restricted to shoreline marshes, most commonly found in deep-water cattail marshes and in meadow marshes. The greatest numbers can be found in dyked wetlands, but it may also be found in open wet woods, thickets, spoil banks, and drainage ditches.	No	Low
	Virginia Mallow *(Sida hermaphrodita)*	Schedule 1, Endangered	Endangered	Endangered	Virginia mallow grows in riparian habitats that are flooded in most years. It benefits from this moist environment and is usually found in sunny or partly shaded areas with sandy soils. Loose sandy or rocky soils of scoured riverside and floodplains, and disturbed areas along roadsides and railroad banks are its preferred habitat.	Medium	Medium

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	White Wood Aster *(Eurybia divaricata)*	Schedule 1, Threatened	Threatened	Threatened	White wood aster grows in open, dry deciduous forests that are dominated by Sugar maple and American beech trees. It is often found mixed in with other asters. The plant does best in well-drained soils and it may prefer a low level of disturbance, as it has been found to grow along trails. It does well in full to partial shade.	No	Low
	Spotted Wintergreen *(Chimaphila maculata)*	Schedule 1, Endangered	Threatened	Endangered	Spotted Wintergreen occurs in semi-open habitats of dry oak-pine woodland habitats with sandy soils. Typically, dominant tree species include White Pine, Red Oak, Black Oak, and American Beech. In Canada, all extant sites are very close to the Great Lakes which have an ameliorating effect on the climate.	Medium	Medium
Snakes and Lizards	Eastern Ribbonsnake *(Thamnophis sauritas)*	Schedule 1, Special Concern	Special Concern	Special Concern	Sunny grassy areas with low dense vegetation near bodies of shallow permanent quiet water; wet meadows, grassy marshes or sphagnum bogs; borders of ponds, lakes or streams; hibernates in groups.	Low	Low
	Eastern hog-nosed snake *(Heterodon platirhinos)*	Schedule 1, Threatened	Threatened	Threatened	The Eastern Hog-nosed Snake specializes in hunting and eating toads, and usually only occurs where toads can be found. Eastern Hog-nosed Snakes prefer sandy, well-drained habitats such as beaches and dry forests where they can lay their eggs and hibernate. They use their up-turned snout to dig burrows below the frost line in the sand where eggs are deposited.	Medium	Medium
	Common Five-lined Skink*(Plestiodon fasciatus)*	Schedule 1, Special Concern	Special Concern	Special Concern	The Common Five-lined Skink habitat varies from region to region including rocky outcrops, dunes, fields, and deciduous forests. This species is generally associated with relatively clear areas where sunlight can reach the ground. Skinks from the Great Lakes/St. Lawrence population favour large rocky outcrops found within fields or mixed coniferous and deciduous forests, often found underneath rocks on open bedrock.	Low	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Gray Ratsnake *(Pantherophis spiloides)*	Schedule 1, Endangered	Endangered	Endangered	The Gray Ratsnake is semi-arboreal and typically found in a wide variety of woodland habitats across its range. They seem to prefer a mix of agricultural land and deciduous forest, preferring habitat where forest meets more open environments.	No	Low
	Massasauga *(Sistrurus catenatus)*	No Schedule, No Status	Threatened	Threatened	Massasaugas live in different habitats throughout Ontario including tall grass prairie, bogs, marshes, shorelines, forests, and alvars. Massasaugas require open areas to warm themselves in the sun. This species forages and mates in lowland habitats such as grasslands, wetlands, bogs, and shorelines of lakes and rivers. Pregnant females can be found in open, dry habitats such as rock barrens or forest clearings where they can more easily maintain body temperature.	Low	Low
Turtles	Northern Map Turtle *(Graptemys geographica)*	Schedule 1, Special Concern	Special Concern	Special Concern	Large bodies of water with soft bottoms, and aquatic vegetation; basks on logs or rocks or on beaches and grassy edges, will bask in groups; uses soft soil or clean dry sand for nest sites; may nest at some distance from water; home range size is larger for females (about 70ha) than males (about 30ha) and includes hibernation, basking, nesting and feeding areas; aquatic corridors (e.g. stream) are required for movement.	Low	Low
	Snapping Turtle *(Chelydra serpentina)*	Schedule 1, Special Concern	Special Concern	Special Concern	Permanent, semi-permanent fresh water; marshes, swamps or bogs; rivers and streams with soft muddy banks or bottoms; often uses soft soil or clean dry sand on south-facing slopes for nest sites; may nest at some distance from water; home range size ~28 ha in area.	Low	Low

SPECIES GROUP	SPECIES NAME (*scientific name*)	CLASSIFICATION			HABITAT DESCRIPTION	HABITAT POTENTIAL ON SITE (NO/LOW/MED/ HIGH)	HABITAT POTENTIAL WITHIN THE STUDY AREA (NO/LOW/MED/ HIGH)
		SARA	COSEWIC	PROV.			
	Blanding's Turtle *(Emydoidea blandingii)*	Schedule 1, Endangered	Endangered	Threatened	Blanding's Turtles are primarily aquatic, living in several type of freshwater environments, including lakes, permanent or temporary pools, slow-flowing streams, marshes, and swamps. This species generally prefers shallow water that is rich in nutrients, organic soil, and dense vegetation. They often stay along the edge of the water, and also require terrestrial environments, usually nesting in dry conifer or mixed hardwood forests up to 410 m from any body of water. They dig their nest in a variety of loose substrates, including sand, organic soil, gravel, and cobblestone.	Low	Low
	Spotted Turtle *(Clemmys guttata)*	Schedule 1, Endangered	Endangered	Endangered	The Spotted Turtle is semi-aquatic and prefers ponds, marshes, bogs, and even ditches with slow-moving unpolluted water and an abundant supply of aquatic vegetation. Females nest in sunny locations where there is not a lot of woody vegetation. The species usually hibernates in wetlands or seasonally wet areas associated with structures including overhanging banks, hummocks, tree roots, or aquatic animal burrows.	Low	Low
	Spiny Softshell *(Apalone spinifera)*	Schedule 1, Endangered	Endangered	Endangered	Spiny softshells are highly aquatic turtles that rarely travel far from water. They are found primarily in rivers and lakes but also in creeks and even ditches and ponds near rivers. Key habitat requirements are open sand or gravel nesting areas, shallow muddy, or sandy areas to bury in, deep pools for hibernation, and areas for basking.	Low	Low
	Eastern Musk Turtle *(Sternotherus odaratus)*	Schedule 1, Threatened	Special Concern	Special Concern	Eastern Musk Turtles are found in rivers, lakes, bays, streams, ponds, canals, and swamps with little to no current, have abundant emergent vegetation, and soft, muddy bottoms that they burrow into for winter hibernation. Nesting habitats vary, but they must be close to the water and exposed to direct sunlight. Nesting females dig shallow excavations in sand, at the base of dune grasses, decaying vegetable matter, rotting wood, and in the walls of Muskrat or Beaver lodges.	Low	Low

6.3 SUMMARY

Based on the above-noted findings, there is the potential that the preferred habitat(s) of certain Species at Risk exists at/near the Site.

7 REVIEW AND EVALUATION OF INFORMATION

Based on information collected during this Updated Phase I ESA, including historical records reviews, interviews, and site reconnaissance, the following summary is provided:

The Site is an irregular-shaped, approximate 1.2 hectare property occupied by the Canadian Coast Guard. The Site is currently owned by the St. Lawrence Seaway Management Corporation. The Site is currently developed with seven enclosed structures comprised of the Main building, four storage sheds, a portable office and an Environment Canada Hydrometric Gauging Station. The Main building is utilized for office space (southern portion), minor repair and servicing of general equipment (central portion) and a residence (northern portion) for the Canadian Coast Guard. The storage sheds are utilized for the storage of equipment for search and rescue operations. The portable office is a prefabricated structure supported on a concrete platform, which is used by the Canadian Coast Guard Engineer for general office duties. The Environment Canada Hydrometric Gauging Station is used by Environment Canada staff to obtain data from Lake Ontario. The Site is bordered to the west by Lake Ontario and the east by the Welland Canal water way. The adjoining lands to the north and south are vacant, with a driveway traversing the Site in a north to south direction.

According to the historical records review, the Site was first developed with the construction of the Main building, circa 1931. Based on a review of available aerial photographs, the Site appears to have been vacant land in 1927. According to discussions with the Site representative, the Site was first created by lake filling from the construction of the Welland Canal in the early 1900s.

Based on the findings of the Phase I ESA, the following Areas of Potential Environmental Concern (APECs) and Areas of Environmental Concern (AECs) were identified as summarized below.

Table 6: APEC and AEC Summary Table

APEC # / AEC #	ISSUE / SOURCE	REFERENCE	SUSPECTED OR KNOWN COC	PICTURE NUMBER	RECOMMENDATION	COST ESTIMATE
AEC 1	Issue: Fill material of unknown environmental quality at the Site, including known soil and groundwater impacts at the Site from previous subsurface	Englobe 2018 Updated Phase I ESA and 2017 Geotechnical Investigation	Known COCs: Soil: Metals (beryllium, copper, lead and zinc) and/or pH	N/A	Conduct a Phase II ESA to confirm the extent of the soil and groundwater impacts.	$8,000 to $10,000

APEC # / AEC #	ISSUE / SOURCE	REFERENCE	SUSPECTED OR KNOWN COC	PICTURE NUMBER	RECOMMENDATION	COST ESTIMATE
	investigations. Source: The Site was first created by lake filling from the construction of the Welland Canal in the early 1900s.	report	Groundwater: chloride and uranium			
APEC 1	Issue: The current and historic handling and storage of liquids fuels at the Site in six ASTs, including the associated underground piping which extends from the 11,000 L diesel fuel AST to the fuel dispenser located along the eastern portion of the Site. Source: Liquid fuels stored in ASTs.	Englobe 2018 Updated Phase I ESA Site visit	Suspected COCs: PHC F1-F4, BTEX, VOCs and/or Metals	5, 6, 7 and 8	Conduct a Phase II ESA to confirm the current environmental quality of the soil and groundwater in the vicinity of the ASTs and any associated piping.	$30,000 to $40,000

The Statement of Limitations is an integral part of this report and should be considered when reviewing this document and the findings and conclusions contained herein.

STATEMENT OF LIMITATIONS

Englobe prepared this report for the use of PWGSC. The material in it reflects the judgment of Englobe in light of the information made available at the time of preparation. Any use, which a Third Party makes of this report, or any reliance on discussions to be made based on it, is the responsibility of such Third Parties. Englobe accepts no responsibility for damages, if any, suffered by any Third Party because of decisions made or actions taken based on this report.

It should be noted that this Phase I Environmental Site Assessment was focused on observed environmental or waste management practices that have or potentially could have an adverse impact on the Site located at 4 Welland Canals Parkway in St. Catharines, Ontario. It was not intended to be a detailed audit of past and present operations and no intrusive investigations were carried out.

More exhaustive examinations including hydrogeological or subsurface investigations may encounter conditions not apparent at the time of this assessment. This assessment is subject to any restrictions placed by physical obstructions, precipitation, denied access, inaccessible areas including occupied tenant areas, time constraints, cost constraints, readily available documentation, safety considerations, confidentiality, and availability of knowledgeable individuals for interview purposes.

A reasonable site evaluation may not identify latent or hidden contamination or features. Information in this assessment may also change with time and thus only be accurate on the collection date.

It should be noted that assessments made throughout this environmental assignment rely heavily on information supplied by others. While every effort has been made to use reliable and multiple sources, Englobe makes no guaranty of the accuracy or completeness of this third party information available to us at the time of preparing this report. This site assessment is a compilation and assessment of available data regarding the Site and in no way should be considered as a recommendation or rejection of a potential property purchase.

REFERENCES

Barnett, P.J. 1992 Quaternary Geology of Ontario; in Geology of Ontario, Special Volume 4, Part 2, p. 1009-1088

Chapman, L.J., Putman, D.F., 1984. The Physiography of Southern Ontario, Third Edition; Ontario Geological Survey, Special Volume 2

Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey Miscellaneous Release – Data 22

MOECC, June 1991, Waste Disposal Site Inventory

MOECC, April 1987, Inventory of Coal Gasification Plant Waste Sites in Ontario

MOECC, November 1988, Inventory of Industrial Sites Using Coal Tars and Related Tars in Ontario

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release – Data 126-Revision 1

Ontario Geological Survey 2010, Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release-Data 128-Revised

Ontario Government, *Occupational Health and Safety Act*, Bill 208

Ontario Government, RSO 1990, *Gasoline Handling Act*

Ontario Government, Energy Act, Fuel Oil Code, Regulation 288

Ontario Government, RSO 1990, *Ontario Environmental Protection Act*

CCME Phase I/II Environmental Site Assessment, Search and Rescue Station, Port Weller, Ontario, prepared by Aqua Terre Solutions Inc. for Public Works and Government Services Canada and Department of Fisheries and Oceans, dated February 11, 2009.

Hazardous Building Materials Assessment, Fisheries and Oceans Canada, Port Weller, St. Catharines, Ontario, prepared by Pinchin Environmental Ltd. (Pinchin) for Fisheries and Oceans Canada, dated April 3, 2014.

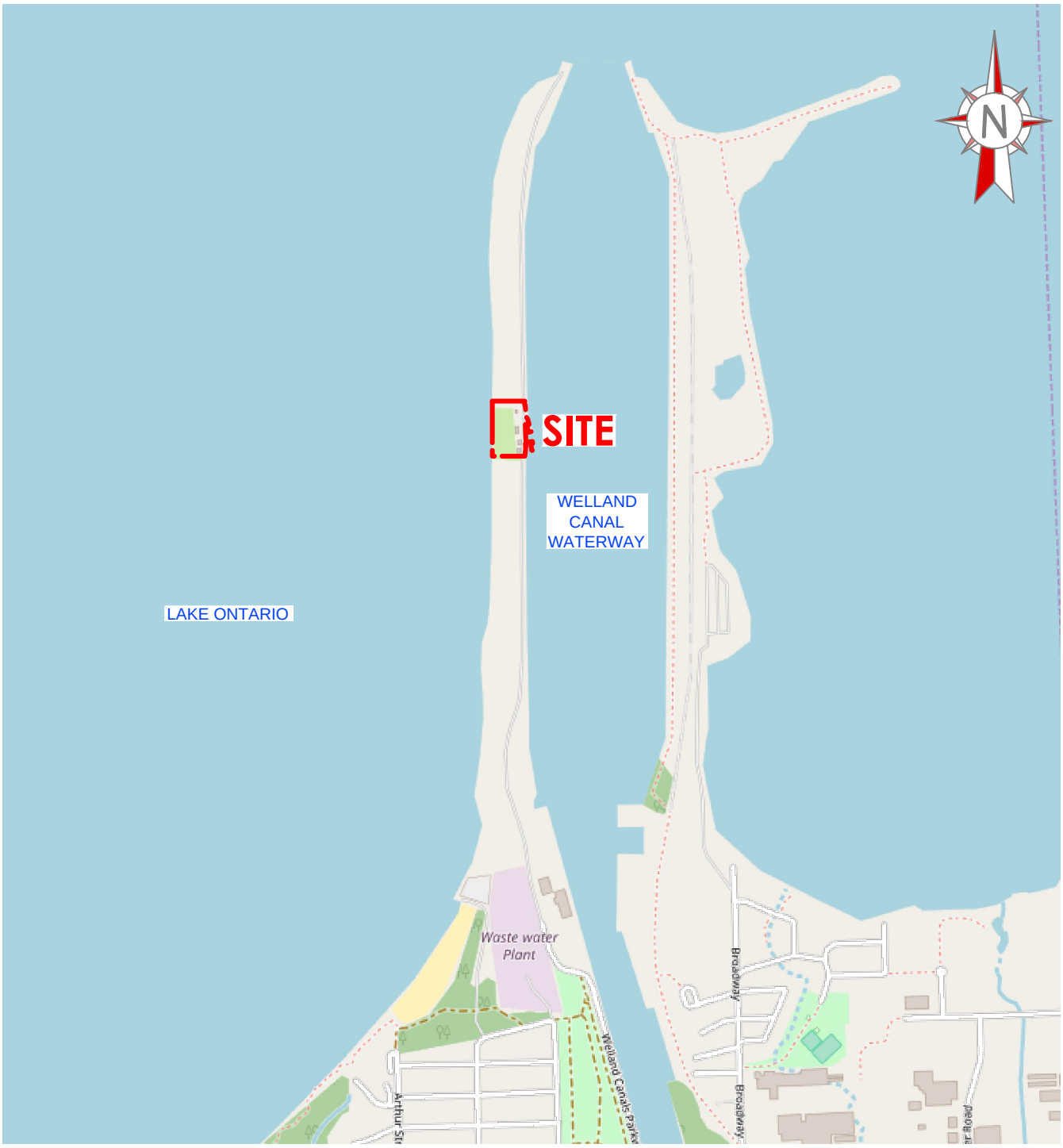
Project-Specific Designated Substance Survey – Galley House and Office House, Fisheries and Oceans Canada, Port Weller, Ontario, prepared by DST Consulting Engineers Inc. (DST) for Fisheries and Oceans Canada, dated February 13, 2017.

Project Effects Determination for Partial Demolition and Addition Project: Port Weller Coast Guard Station DFRP#86422, prepared by DST for PWGSC, dated November 2017.

Draft Geotechnical Investigation Report, prepared by Englobe Corp. for PWGSC, dated November 8, 2017.

Appendix 1 Drawings

Drawing 1: Location Plan
Drawing 2: Site and Surrounding Land Use Plan
Drawing 3: Site Plan
Drawing 4: 2010 Ontario Base Map
Drawing 5: 1927 Aerial Photograph
Drawing 6: 1948 Aerial Photograph
Drawing 7: 1965 Aerial Photograph
Drawing 8: 1988 Aerial Photograph
Drawing 9: 2015 Aerial Photograph



NOTES :
1-REFERENCES : © OpenStreetMap contributors (2017).

0 100 200 300 400 500 m
SCALE 1:15000

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

Title

LOCATION PLAN

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	ENVIRONMENTAL	Project manager	A.Dunbrack
Drawn	E.Ciochon	Scale	1 : 15000	Sequence no.	01 of 09
Checked	A.Dunbrack	Date	2018-03-27		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	001	00

G:\161\DRAFTING FOR LONDON\P-0009072\225\P-0009072-0-01-225_DWG001.DWG

LEGEND :

SITE OUTLINE

0 50 100 150 200 m

SCALE 1:5000

NOTES :

1-REFERENCES: MINISTRY OF AGRICULTURAL, FOOD AND RURAL AFFAIRS @ Queen's Printer for Ontario, 2015 Aerial Photograph (2017).

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

Title

SITE PLAN AND SURROUNDING LAND USE

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	ENVIRONMENTAL	Project manager	A.Dunbrack
Drawn	E.Ciochon	Scale	1 : 5000	Sequence no.	02 of 09
Checked	A.Dunbrack	Date	2018-03-27		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	002	00

G:\161\DRAFTING FOR LONDON\P-0009072\225\P-0009072-0-01-225_DWG002.DWG

LEGEND :

- SITE OUTLINE
- MONITORING WELL/BOREHOLE LOCATION (Englobe Geotechnical Investigation, 2017)
- BOREHOLE LOCATION (Aqua Terre Investigation, 2009)
- A — ABOVEGROUND STORAGE TANK
- POTABLE WATER WELL

NOTES :

1-REFERENCES:

- MINISTRY OF AGRICULTURAL, FOOD AND RURAL AFFAIRS @ Queen's Printer for Ontario, 2015 Aerial Photograph (2017).
- Englobe, Project No.B-0017786, September 2017.
- AQUA TERRE, Project No.08228D, Drawing No.FIGURE 2, October, 2008 and Figure 3 January, 2009.

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 5 10 15 m

SCALE 1:500

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

Title

SITE PLAN

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

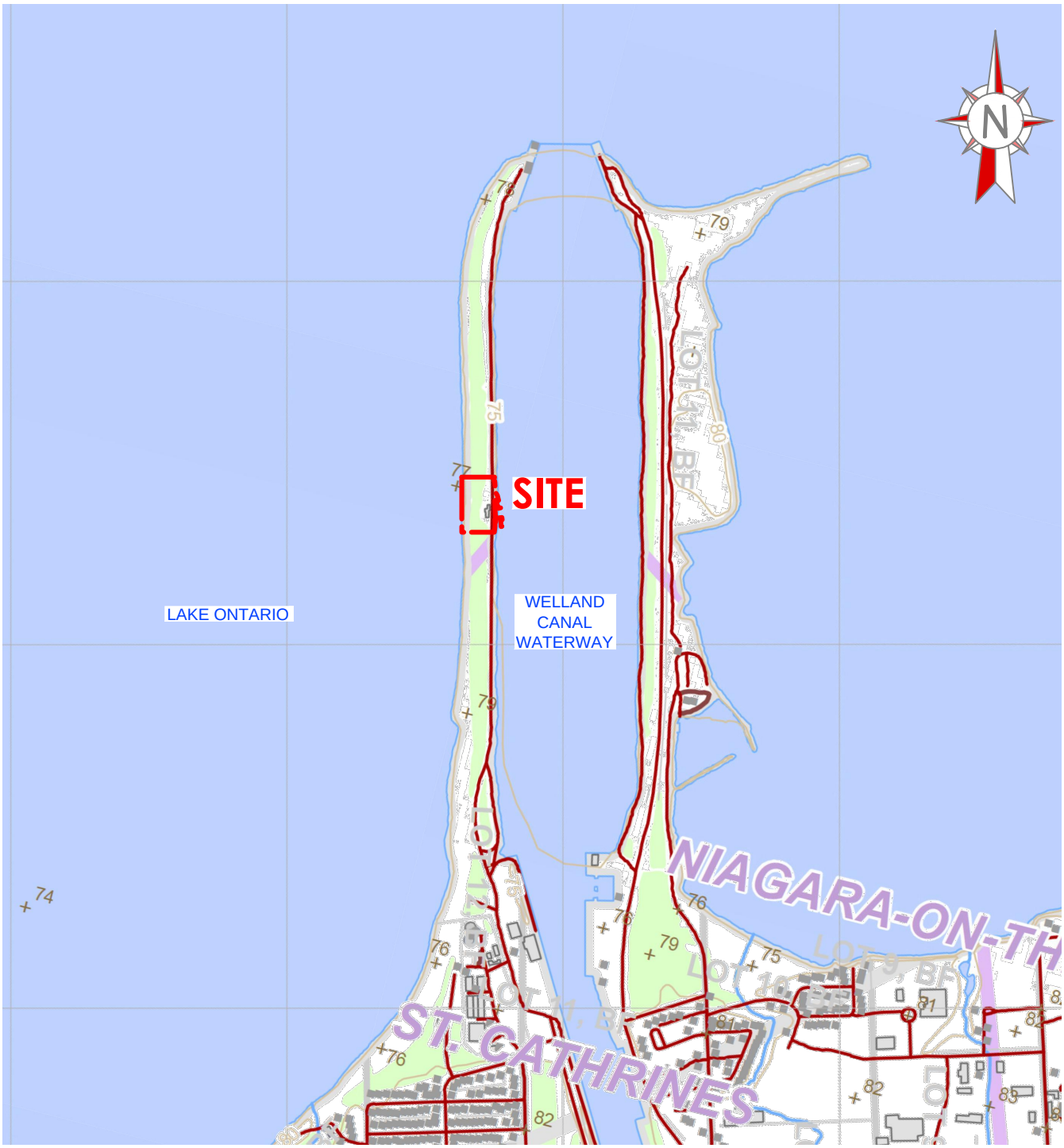
Prepared	E.Ciochon	Discipline	ENVIRONMENTAL
Drawn	E.Ciochon	Scale	1 : 500
Checked	A.Dunbrack	Date	2018-03-27

Project manager: A.Dunbrack
Sequence no.: 03 of 09

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	003	00

10 cm 5 4 3 2 1 0

G:\161\DRAFTING FOR LONDON\P-0009072\225\P-0009072-0-01-225_DWG003.DWG



NOTES :
1-REFERENCES : 2010 ONTARIO BASE MAPPING CENTRE (OBM) Data (2017), Reference No.20171205261.

0 100 200 300 400 500 m

SCALE 1:15000

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

Title

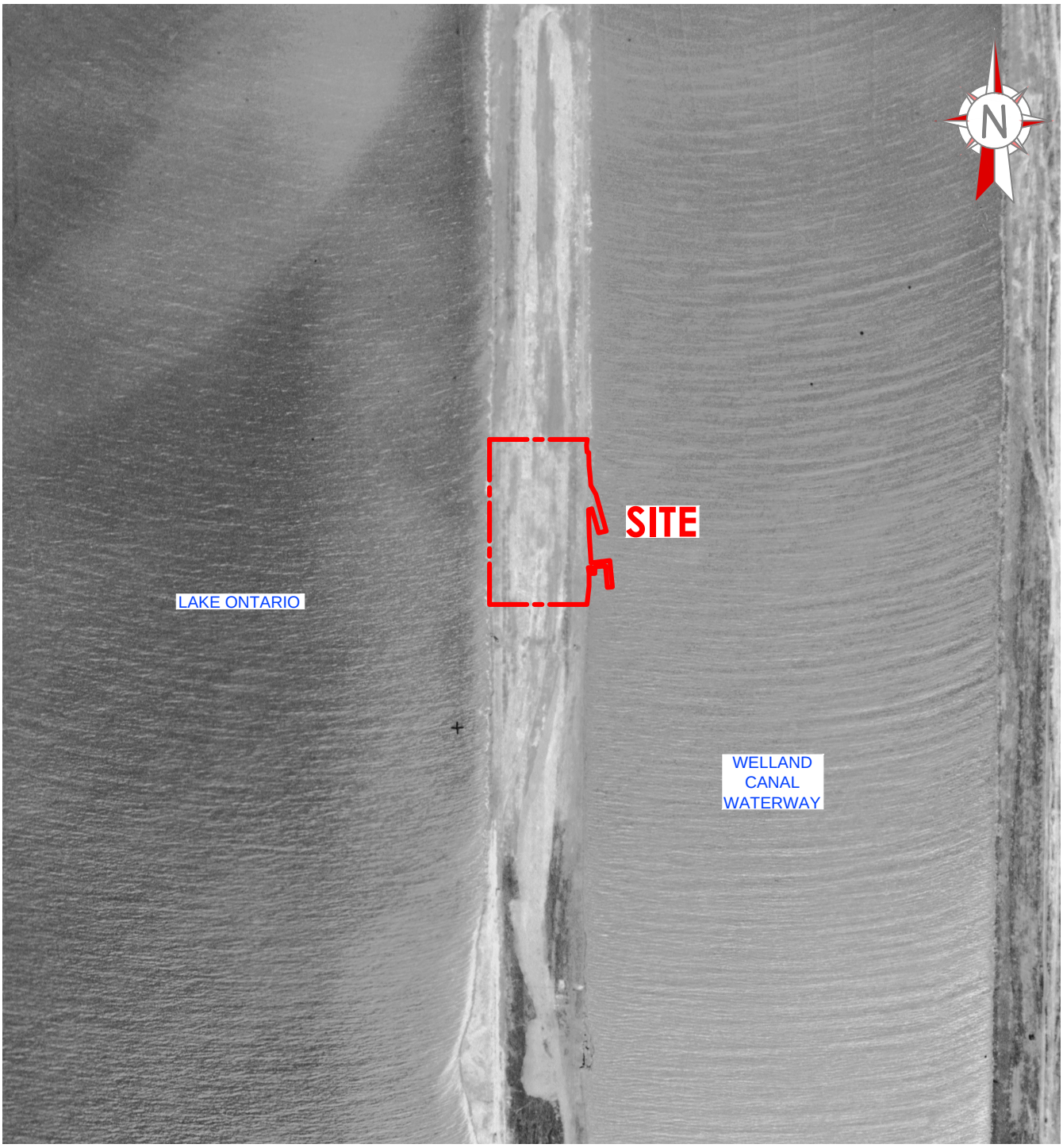
2010 ONTARIO BASE MAP

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	ENVIRONMENTAL	Project manager	A.Dunbrack
Drawn	E.Ciochon	Scale	1 : 15000	Sequence no.	04 of 09
Checked	A.Dunbrack	Date	2018-03-27		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	004	00

G:\161\DRAFTING FOR LONDON\P-0009072\225\P-0009072-0-01-225_DWG004.DWG



0 50 100 150 200 m

SCALE 1:5000

NOTES :
1-REFERENCES : 1927 Aerial Photograph,
Reference No.R.A.15-72.

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

Title

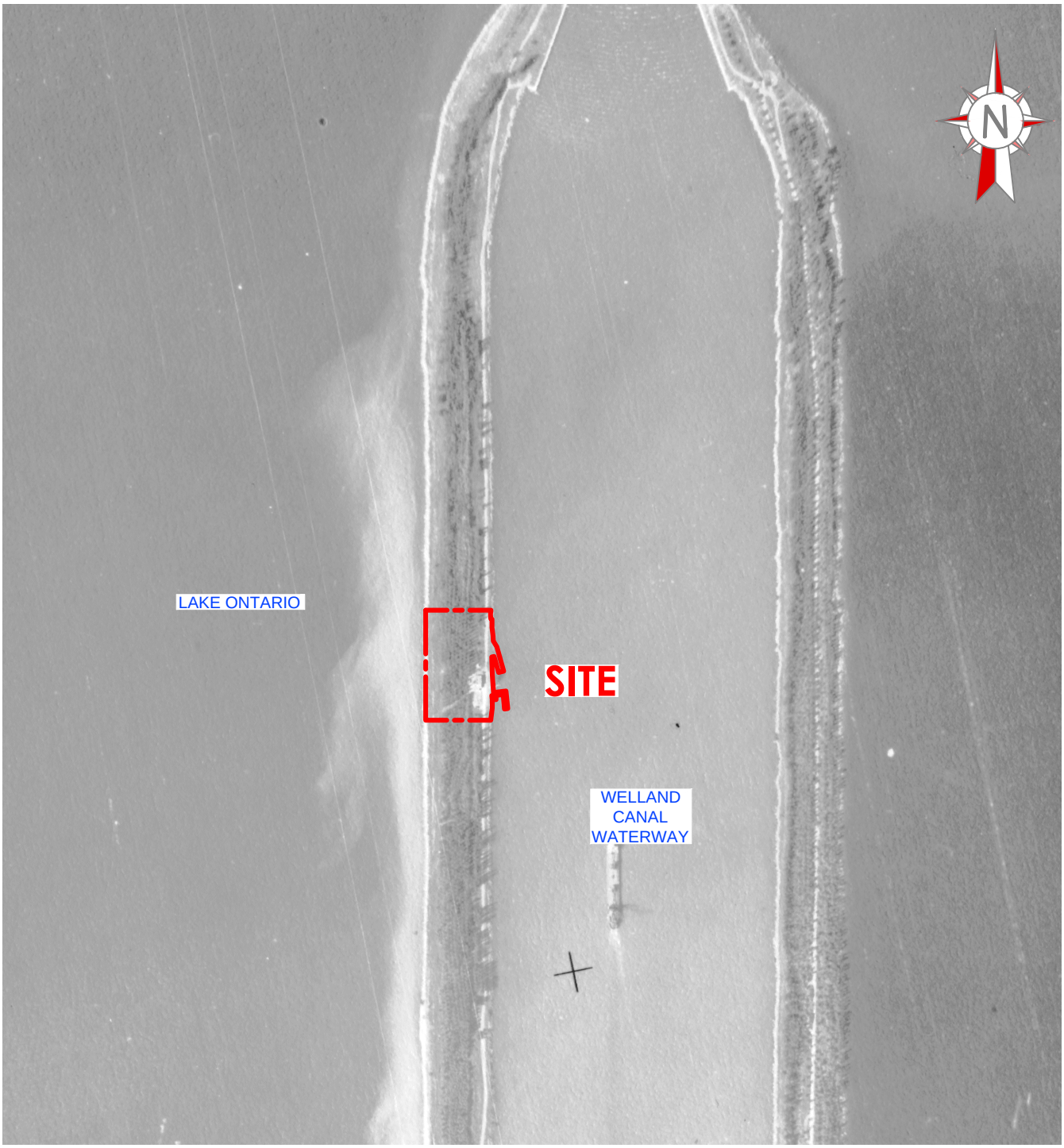
1927 AERIAL PHOTOGRAPH

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	ENVIRONMENTAL	Project manager	A.Dunbrack
Drawn	E.Ciochon	Scale	1 : 5000	Sequence no.	05 of 09
Checked	A.Dunbrack	Date	2018-03-27		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	005	00

G:\161\DRAFTING FOR LONDON\P-0009072\225\P-0009072-0-01-225_DWG005.DWG



0 100 200 300 m

SCALE 1:7500

NOTES :
1-REFERENCES : 1948 Aerial Photograph,
Reference No.A11612-40.

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

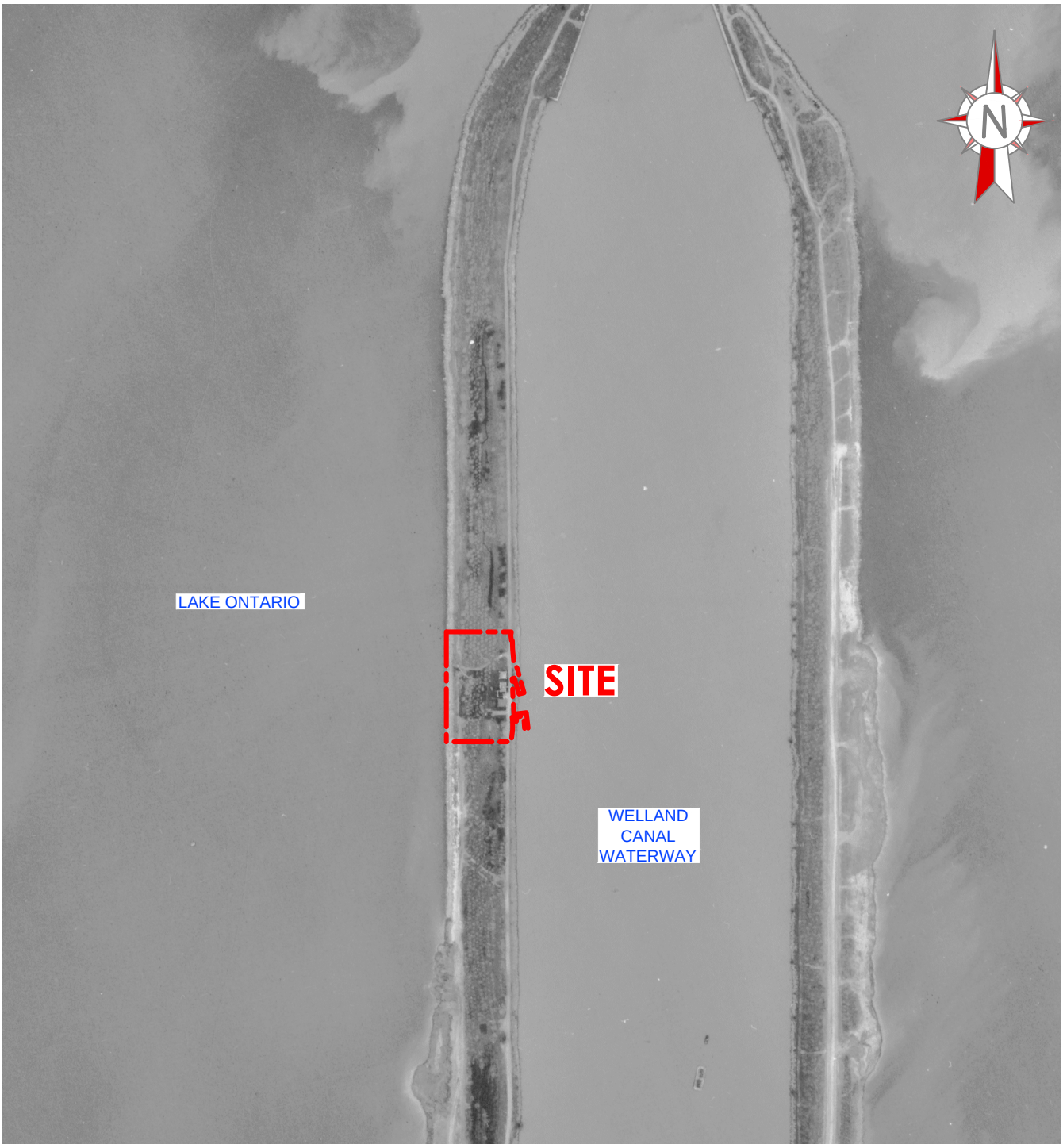
Title

1948 AERIAL PHOTOGRAPH

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	ENVIRONMENTAL	Project manager	A.Dunbrack
Drawn	E.Ciochon	Scale	1 : 7500	Sequence no.	06 of 09
Checked	A.Dunbrack	Date	2018-03-27		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	006	00



0 100 200 300 m

SCALE 1:7500

NOTES :
1-REFERENCES : 1965 Aerial Photograph,
Reference No.A18756-149.

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

Title

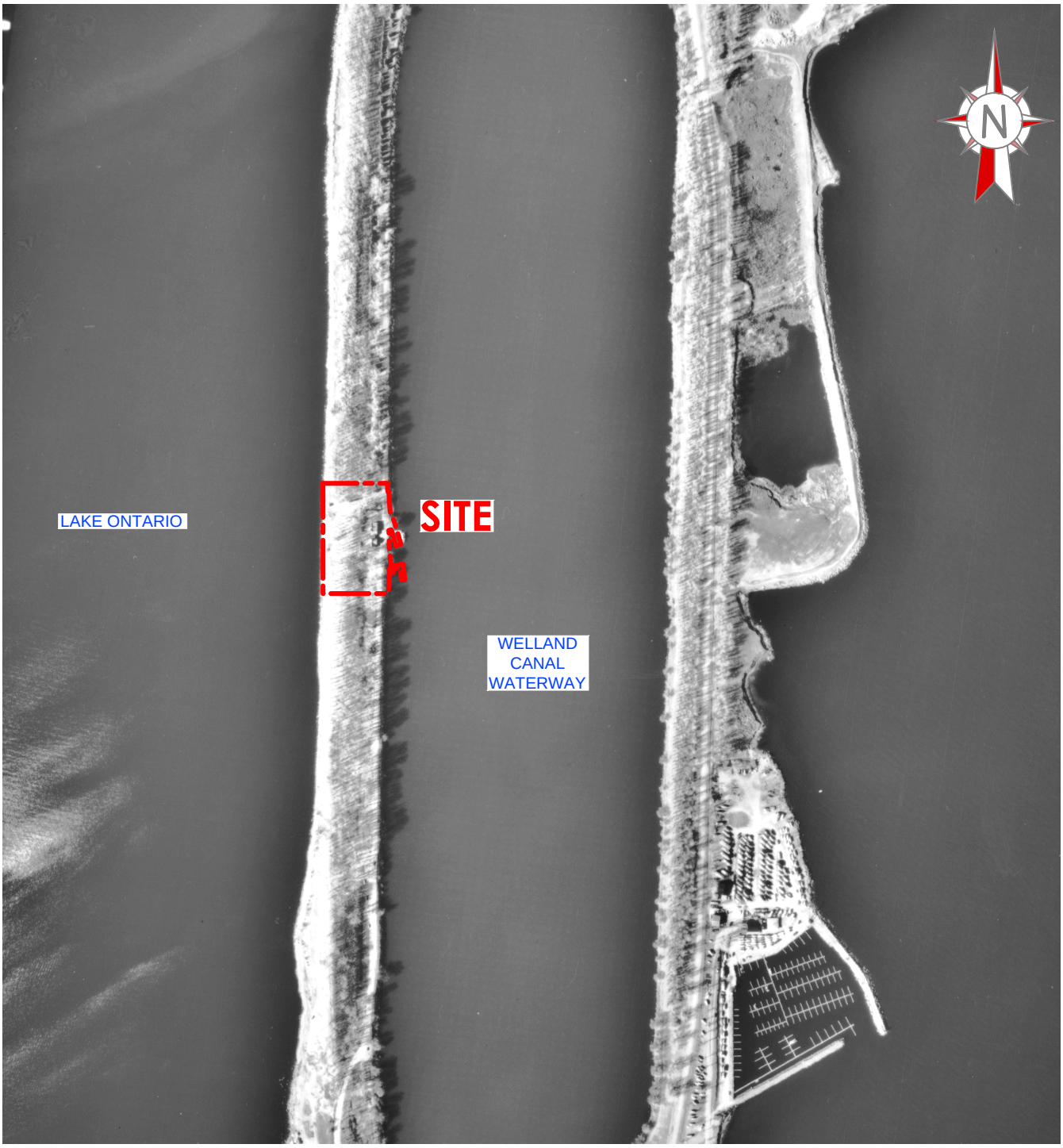
1965 AERIAL PHOTOGRAPH

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	ENVIRONMENTAL	Project manager	A.Dunbrack
Drawn	E.Ciochon	Scale	1 : 7500	Sequence no.	07 of 09
Checked	A.Dunbrack	Date	2018-03-27		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	007	00

G:\161\DRAFTING FOR LONDON\P-0009072\225\P-0009072-0-01-225_DWG007.DWG



NOTES :
1-REFERENCES : 1988 Aerial Photograph,
Reference No.A27265-98.

0 100 200 300 m
SCALE 1:7500

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

Title

1988 AERIAL PHOTOGRAPH

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	ENVIRONMENTAL	Project manager	A.Dunbrack
Drawn	E.Ciochon	Scale	1 : 7500	Sequence no.	08 of 09
Checked	A.Dunbrack	Date	2018-03-27		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	008	00

G:\161\DRAFTING FOR LONDON\P-0009072\225\P-0009072-0-01-225_DWG008.DWG

NOTES :
1-REFERENCES : MINISTRY OF AGRICULTURAL, FOOD AND RURAL AFFAIR @ Queen's Printer for Ontario, 2015 Aerial Photograph (2017).

0 100 200 300 m
SCALE 1:7500

Project

Update Phase I Environmental Site Assessment

4 Welland Canals Parkway, St.Catharines, Ontario

Title

2015 AERIAL PHOTOGRAPH

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	ENVIRONMENTAL	Project manager	A.Dunbrack
Drawn	E.Ciochon	Scale	1 : 7500	Sequence no.	09 of 09
Checked	A.Dunbrack	Date	2018-03-27		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0009072-0-01-225	SG	009	00

G:\161\DRAFTING FOR LONDON\P-0009072\225\P-0009072-0-01-225_DWG009.DWG

Appendix 2 Site Photographs

Photographs 1 to 16

Photograph 1: Main building as viewed from the southwestern portion of the Site.

Photograph 2: Main building (northern portion) as viewed from the eastern portion of the Site, looking in a westerly direction.

Photograph 3: Portable office, located to the north of the Main building on Site.

Photograph 4: Storage sheds #1 and #2, as viewed from the northeastern portion of the Site, facing southwest

Photograph 5: Fuel oil ASTs (1,100 L each) and pad mounted air conditioning unit located along the western exterior wall of the Main building.

Paragraph 6: Diesel AST (600 L) located along the northwestern exterior wall of the Main building.

Photograph 7: Diesel AST (11,000 L) located to the north of the Main building.

Photograph 8: Gasoline AST (1,900 L), waste oil AST (500 L) and bilge water drums located to the west of storage shed # 1.

Photograph 9: On Site potable water well located on the southern portion of the Site.

Photograph 10: Hazadous good storage cabinets located within storage shed #1.

Photograph 11: Office area, southern portion of the Main building.

Photograph 12: Minor repair and servicing of equipment area within the central portion of the Main building.

Photograph 13: Fuel dispenser and storage shed #4 located on the western portion of the Site.

Photograph 14: Adjacent lands to the north of the Site.

Photograph 15: Welland Canal located to the east of the Site.

Photograph 16: Lake Ontario located to the west of the Site.

Appendix 3 ERIS Documents

ERIS Report No. 20171205261
ERIS City Directory Information Source
ERIS – Opta Historical Environmental Services Enviroscan

ENVIRONMENTAL RISK INFORMATION SERVICES

DATABASE REPORT

Project Property:	*Port Weller* *Welland Canal Parkway* *Welland ON*
Project No:	*81885*
Report Type:	*Standard Report*
Order No:	*20171205261*
Requested by:	*EnGlobe Corp.*
Date Completed:	*December 12, 2017*

Environmental Risk Information Services
A division of Glacier Media Inc.
P: 1.866.517.5204
E: info@erisinfo.com

www.erisinfo.com

Table of Contents

Executive Summary

Property Information:

Project Property:	*Port Weller* *Welland Canal Parkway Welland ON*
Project No:	*81885*

Coordinates:

Latitude:	*43.236579*
Longitude:	*-79.218988*
UTM Northing:	*4,788,626.88*
UTM Easting:	*644,610.66*
UTM Zone:	*UTM Zone 17T*

Elevation: *246 FT*
74.83 M

Order Information:

Order No:	*20171205261*
Date Requested:	*December 5, 2017*
Requested by:	*EnGlobe Corp.*
Report Type:	*Standard Report*

Historical/Products:

Aerial Photographs	*National Collection - Digital (PDF)*
Insurance Products	*Fire Insurance Maps/Inspection Reports/Site Specific Plans*
Topographic Map	*Ontario Base Map (OBM)*

Executive Summary: Report Summary

Database	Name	Searched	Project Property	Within 0.25 km	Total
AAGR	*Abandoned Aggregate Inventory*	Y	0	0	0
AGR	*Aggregate Inventory*	Y	0	0	0
AMIS	*Abandoned Mine Information System*	Y	0	0	0
ANDR	*Anderson's Waste Disposal Sites*	Y	0	0	0
AUWR	*Automobile Wrecking & Supplies*	Y	0	0	0
BORE	*Borehole*	Y	0	0	0
CA	*Certificates of Approval*	Y	0	0	0
CFOT	*Commercial Fuel Oil Tanks*	Y	0	0	0
CHEM	*Chemical Register*	Y	0	0	0
CNG	*Compressed Natural Gas Stations*	Y	0	0	0
COAL	*Inventory of Coal Gasification Plants and Coal Tar Sites*	Y	0	0	0
CONV	*Compliance and Convictions*	Y	0	0	0
CPU	*Certificates of Property Use*	Y	0	0	0
DRL	*Drill Hole Database*	Y	0	0	0
EASR	*Environmental Activity and Sector Registry*	Y	0	0	0
EBR	*Environmental Registry*	Y	0	0	0
ECA	*Environmental Compliance Approval*	Y	0	0	0
EEM	*Environmental Effects Monitoring*	Y	0	0	0
EHS	*ERIS Historical Searches*	Y	0	1	1
EIIS	*Environmental Issues Inventory System*	Y	0	0	0
EMHE	*Emergency Management Historical Event*	Y	0	0	0
EXP	*List of TSSA Expired Facilities*	Y	0	0	0
FCON	*Federal Convictions*	Y	0	0	0
FCS	*Contaminated Sites on Federal Land*	Y	0	1	1
FOFT	*Fisheries & Oceans Fuel Tanks*	Y	0	0	0
FST	*Fuel Storage Tank*	Y	0	0	0
FSTH	*Fuel Storage Tank - Historic*	Y	0	0	0
GEN	*Ontario Regulation 347 Waste Generators Summary*	Y	0	11	11
GHG	*Greenhouse Gas Emissions from Large Facilities*	Y	0	0	0
HINC	*TSSA Historic Incidents*	Y	0	0	0
IAFT	*Indian & Northern Affairs Fuel Tanks*	Y	0	0	0
INC	*TSSA Incidents*	Y	0	0	0
LIMO	*Landfill Inventory Management Ontario*	Y	0	0	0
MINE	*Canadian Mine Locations*	Y	0	0	0
MNR	*Mineral Occurrences*	Y	0	0	0
NATE	*National Analysis of Trends in Emergencies System (NATES)*	Y	0	0	0

Database	Name	Searched	Project Property	Within 0.25 km	Total
NCPL	Non-Compliance Reports	Y	0	0	0
NDFT	National Defense & Canadian Forces Fuel Tanks	Y	0	0	0
NDSP	National Defense & Canadian Forces Spills	Y	0	0	0
NDWD	National Defence & Canadian Forces Waste Disposal Sites	Y	0	0	0
NEBI	National Energy Board Pipeline Incidents	Y	0	0	0
NEBW	National Energy Board Wells	Y	0	0	0
NEES	National Environmental Emergencies System (NEES)	Y	0	0	0
NPCB	National PCB Inventory	Y	0	0	0
NPRI	National Pollutant Release Inventory	Y	0	0	0
OGW	Oil and Gas Wells	Y	0	0	0
OOGW	Ontario Oil and Gas Wells	Y	0	0	0
OPCB	Inventory of PCB Storage Sites	Y	0	0	0
ORD	Orders	Y	0	0	0
PAP	Canadian Pulp and Paper	Y	0	0	0
PCFT	Parks Canada Fuel Storage Tanks	Y	0	0	0
PES	Pesticide Register	Y	0	0	0
PINC	TSSA Pipeline Incidents	Y	0	0	0
PRT	Private and Retail Fuel Storage Tanks	Y	0	0	0
PTTW	Permit to Take Water	Y	0	0	0
REC	Ontario Regulation 347 Waste Receivers Summary	Y	0	0	0
RSC	Record of Site Condition	Y	0	0	0
RST	Retail Fuel Storage Tanks	Y	0	0	0
SCT	Scott's Manufacturing Directory	Y	0	0	0
SPL	Ontario Spills	Y	0	0	0
SRDS	Wastewater Discharger Registration Database	Y	0	0	0
TANK	Anderson's Storage Tanks	Y	0	0	0
TCFT	Transport Canada Fuel Storage Tanks	Y	0	0	0
VAR	TSSA Variances for Abandonment of Underground Storage Tanks	Y	0	0	0
WDS	Waste Disposal Sites - MOE CA Inventory	Y	0	0	0
WDSH	Waste Disposal Sites - MOE 1991 Historical Approval Inventory	Y	0	0	0
WWIS	Water Well Information System	Y	0	0	0
	Total:		0	13	13

Executive Summary: Site Report Summary - Project Property

Map Key	DB	Company/Site Name	Address	Dir/Dist (m)	Elev diff (m)	Page Number

No records found in the selected databases for the project property.

Executive Summary: Site Report Summary - Surrounding Properties

Map Key	DB	Company/Site Name	Address	Dir/Dist (m)	Elev Diff (m)	Page Number
1	FCS	Port Weller SAR (SAR Station lands)	St. Catharines ON	WSW/37.1	0.00	13
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER NIAGARA-ON-THE-LAKE ON	NNE/70.0	0.00	18
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER C/O ST. LAWRENCE SEAWAY AUTHORITY NIAGARA-ON-THE-LAKE ON L2R 6V8	NNE/70.0	0.00	19
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE/70.0	0.00	19
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	NNE/70.0	0.00	19
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	NNE/70.0	0.00	20
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	NNE/70.0	0.00	20
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	NNE/70.0	0.00	21
2	GEN	CANADIAN COAST GUARD	Port Weller Coast Guard Station End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE/70.0	0.00	21
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE/70.0	0.00	21
2	GEN	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE/70.0	0.00	22
2	GEN	CANADIAN COAST GUARD Search & Rescue	Port Weller Coast Guard Station End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE/70.0	0.00	22
3	EHS		Government Road West St. Catharines ON	NNE/76.2	0.00	22

Executive Summary: Summary By Data Source

EHS - ERIS Historical Searches

A search of the EHS database, dated 1999-Aug 2016 has found that there are 1 EHS site(s) within approximately 0.25 kilometers of the project property.

Equal/Higher Elevation	Address	Direction	Distance (m)	Map Key
	Government Road West St. Catharines ON	NNE	76.24	3

FCS - Contaminated Sites on Federal Land

A search of the FCS database, dated Jun 2000-Mar 2017 has found that there are 1 FCS site(s) within approximately 0.25 kilometers of the project property.

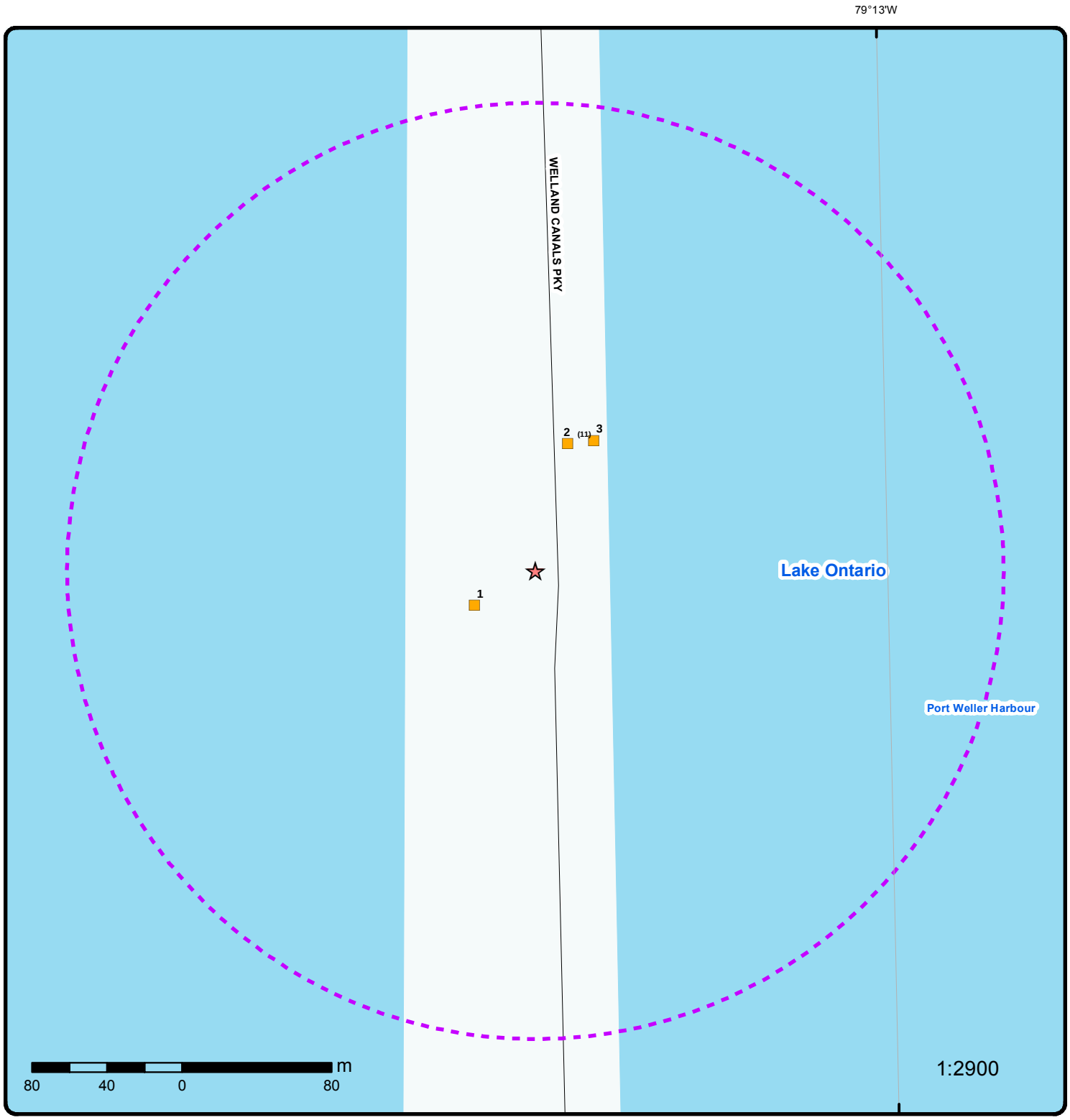
Equal/Higher Elevation	Address	Direction	Distance (m)	Map Key
Port Weller SAR (SAR Station lands)	St. Catharines ON	WSW	37.13	1

GEN - Ontario Regulation 347 Waste Generators Summary

A search of the GEN database, dated 1986-Jun 2017 has found that there are 11 GEN site(s) within approximately 0.25 kilometers of the project property.

Equal/Higher Elevation	Address	Direction	Distance (m)	Map Key
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE	70.04	2
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	NNE	70.04	2
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	NNE	70.04	2
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	NNE	70.04	2
CANADIAN COAST GUARD	Port Weller Coast Guard Station End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE	70.04	2
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE	70.04	2
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE	70.04	2
CANADIAN COAST GUARD Search & Rescue	Port Weller Coast Guard Station End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	NNE	70.04	2
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER C/O ST. LAWRENCE SEAWAY AUTHORITY NIAGARA-ON-THE-LAKE ON L2R 6V8	NNE	70.04	2
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER NIAGARA-ON-THE-LAKE ON	NNE	70.04	2

Equal/Higher Elevation	Address	Direction	Distance (m)	Map Key
CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	NNE	70.04	2



Map : 0.25 Kilometer Radius

Order No: 20171205261

Address: Welland Canal Parkway, Welland, ON

ERIS
ENVIRONMENTAL RISK INFORMATION SERVICES

- Project Property
- Buffer Outline
- Eris Sites with Higher Elevation
- Eris Sites with Same Elevation
- Eris Sites with Lower Elevation
- Eris Sites with Unknown Elevation
- Expressway
- Principal Highway
- Secondary Highway
- Major Road
- Local road
- Trail
- Proposed Road
- Ferry Route/Ice Road
- Industrial and Resource - Regions
- Main Line
- Sidetrack
- Transit Line
- Abandoned Line
- National Park
- Provincial or Territorial Park
- Other Park
- Golf Course or Driving Range
- Park or Sports Field
- Other Recreation Area

Source: © 2015 DMTI Spatial Inc.

79°13'30"W

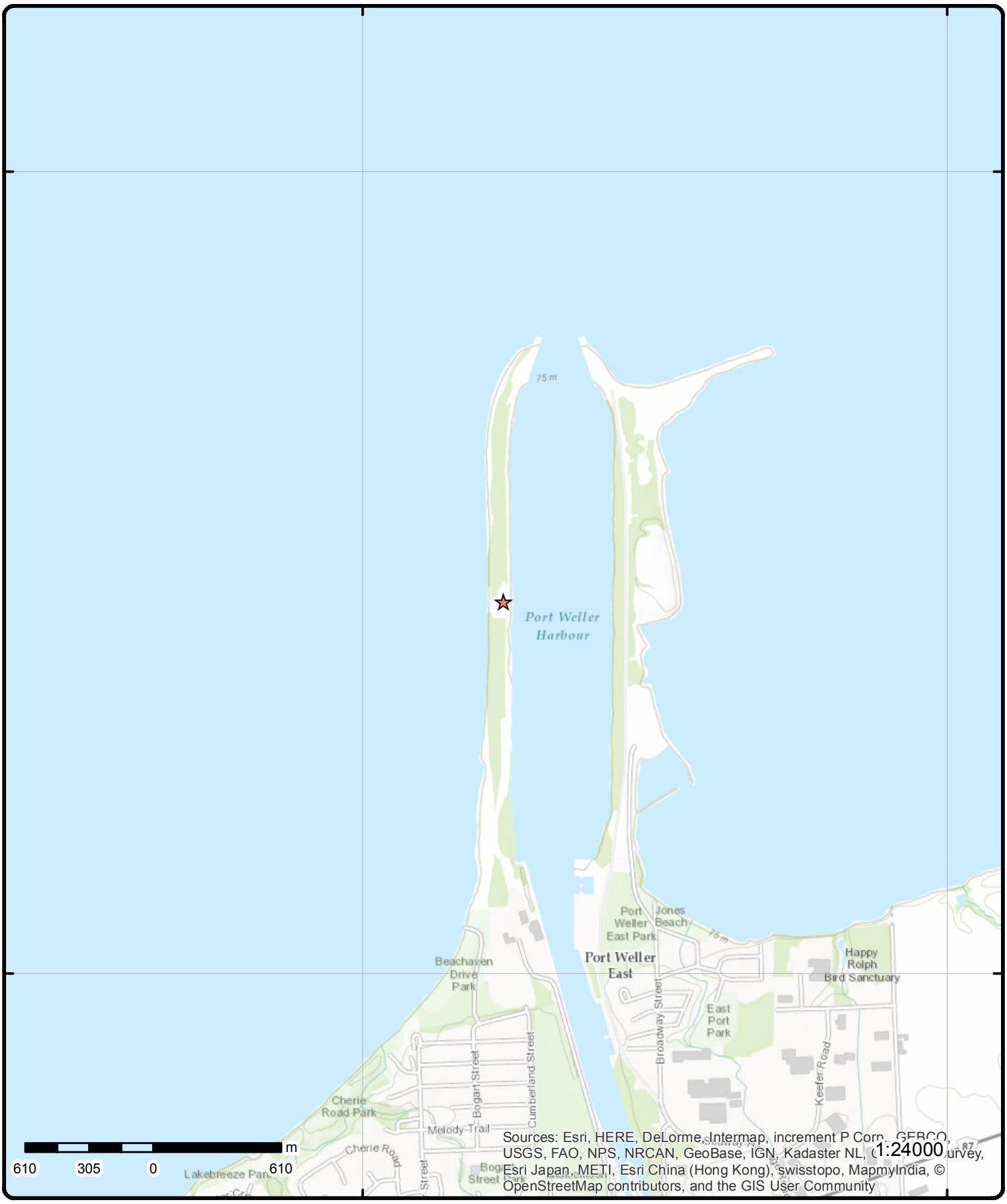
Aerial (2015)

Address: Welland Canal Parkway, Welland, ON

Source: ESRI World Imagery

Order No: 20171205261

ENVIRONMENTAL RISK INFORMATION SERVICES



Topographic Map

Address: Welland Canal Parkway, Welland, ON

Source: ESRI World Topographic Map

Order No: 20171205261

ERIS ENVIRONMENTAL RISK INFORMATION SERVICES

Detail Report

Map Key	Number of Records	Direction/ Distance (m)	Elevation (m)	Site	DB
1	1 of 1	WSW/37.1	74.8	Port Weller SAR (SAR Station lands) St. Catharines ON	FCS

SGC: 3526053
Site ID: 00013997
Departmental ID: C F 00306
Depart Code: DFO
Class Type:
Class:
Site Name: Port Weller SAR (SAR Station lands)
Site Name F: Port Weller SAR (Zones de station de R et S)
Site Status: Closed
Site Status Desc (Fr): Première analyse terminée. Aucune autre mesure nécessaire.
Site Status (Fr): Fermé
Site Status Desc: Initial testing completed. No further action required.
Involv Code:
Census Division: Niagara
Municipality: St. Catharines
Census Sub Class: 1
Latitude: 43.236420
Longitude: -79.219390
Location:
Protected Data: 0
FED: 076
Fed Electoral District: St. Catharines
Fed Electoral District (Fr): St. Catharines
Metro:
Nearest Pop. Area:
Highest Step Cmpltd: 3
Site Deleted Flag:
Created: 2007-03-30T12:14:00
Modified: 2014-05-14T11:13:50.233
Property No.: 86422
Est m³ Contmnted: 0.0000
Est Ha Contmnted: 0.0000
Est Tons Contamin: 0.0000
Km1: 2228
Km10: 146722
Km25: 324619
Km5: 50272
Km50: 1360037
Reporting Org: Fisheries and Oceans Canada
Reporting Org F: Pêches et Océans Canada
Reason for Involv: Federal Real Property
Reason for Involv F: Biens immobiliers fédéraux
Liable Third Party:
Class F:
Action Plan:

Action Plan (Fr):
Site Mgmnt Strategy: Other
Minimap URL:
http://www.tbs-sct.gc.ca/fcsi-rscf/minimap.aspx?fsi=00013997
Additional Info:
Additional Info (Fr):

Management

Management Code: 9
Management Type (EN): Other
Management Type (FR): Autre type de gestion

Annual Data

Fiscal Year: 2013-2014
Reporting Organization: DFO
Highest Step Completed: 03
Total Asmt Expenditure: 0.00
Total Remediation Expenditure: 0.00
Total Care/Maint Expenditur: 0.00
Total Mntring Expenditure: 0.00
FCSAP Asmt Expenditure: 0.00
FCSAP Remediation Expenditure: 0.00
FCSAP Care/Maint Expenditur: 0.00
FCSAP Mntring Expenditure: 0.00
Cubic Metres: 0.0000
Hectares: 0.0000
Tons: 0.0000
Closed:
Class Type:
Class (EN):
Class (FR):
CCME Flag:
CCME NCS Year:
Step Name (EN):
Step Name (FR):
Planned Compl Date Step7:
Planned Compl Date Step8:
Planned Compl Date Step9:
Total Expenditure Reducing Liabil:
Created:
Modified:
NCSCS Year:
Reporting Organization (EN): Fisheries and Oceans Canada
Reporting Organization (FR): Pêches et Océans Canada

Annual Data

Fiscal Year: 2012-2013
Reporting Organization: DFO
Highest Step Completed: 03
Total Asmt Expenditure: 0.00
Total Remediation Expenditure: 0.00
Total Care/Maint Expenditur: 0.00
Total Mntring Expenditure: 0.00
FCSAP Asmt Expenditure: 0.00
FCSAP Remediation Expenditure: 0.00
FCSAP Care/Maint Expenditur: 0.00
FCSAP Mntring Expenditure: 0.00

Cubic Metres: 0.0000
Hectares: 0.0000
Tons: 0.0000
Closed:
Class Type:
Class (EN):
Class (FR):
CCME Flag:
CCME NCS Year:
Step Name (EN):
Step Name (FR):
Planned Compl Date Step7:
Planned Compl Date Step8:
Planned Compl Date Step9:
Total Expenditure Reducing Liabil:
Created:
Modified:
NCSCS Year:
Reporting Organization (EN): Fisheries and Oceans Canada
Reporting Organization (FR): Pêches et Océans Canada

Annual Data

Fiscal Year: 2011-2012
Reporting Organization: DFO
Highest Step Completed: 03
Total Asmt Expenditure: 0.00
Total Remediation Expenditure: 0.00
Total Care/Maint Expenditur: 0.00
Total Mntring Expenditure: 0.00
FCSAP Asmt Expenditure: 0.00
FCSAP Remediation Expenditure: 0.00
FCSAP Care/Maint Expenditur: 0.00
FCSAP Mntring Expenditure: 0.00
Cubic Metres: 0.0000
Hectares: 0.0000
Tons: 0.0000
Closed:
Class Type:
Class (EN):
Class (FR):
CCME Flag:
CCME NCS Year:
Step Name (EN):
Step Name (FR):
Planned Compl Date Step7:
Planned Compl Date Step8:
Planned Compl Date Step9:
Total Expenditure Reducing Liabil:
Created:
Modified:
NCSCS Year:
Reporting Organization (EN): Fisheries and Oceans Canada
Reporting Organization (FR): Pêches et Océans Canada

Annual Data

Fiscal Year: 2010-2011
Reporting Organization: DFO
Highest Step Completed: 03
Total Asmt Expenditure: 0.00

Total Remediation Expenditure:	0.00
Total Care/Maint Expenditur:	0.00
Total Mntring Expenditure:	0.00
FCSAP Asmt Expenditure:	0.00
FCSAP Remediation Expenditure:	0.00
FCSAP Care/Maint Expenditur:	0.00
FCSAP Mntring Expenditure:	0.00
Cubic Metres:	0.0000
Hectares:	0.0000
Tons:	0.0000
Closed:	
Class Type:	
Class (EN):	
Class (FR):	
CCME Flag:	
CCME NCS Year:	
Step Name (EN):	
Step Name (FR):	
Planned Compl Date Step7:	
Planned Compl Date Step8:	
Planned Compl Date Step9:	
Total Expenditure Reducing Liabil:	
Created:	
Modified:	
NCSCS Year:	
Reporting Organization (EN):	Fisheries and Oceans Canada
Reporting Organization (FR):	Pêches et Océans Canada

<u>Annual Data</u>

Fiscal Year:	2009-2010
Reporting Organization:	DFO
Highest Step Completed:	03
Total Asmt Expenditure:	458.00
Total Remediation Expenditure:	0.00
Total Care/Maint Expenditur:	0.00
Total Mntring Expenditure:	0.00
FCSAP Asmt Expenditure:	458.00
FCSAP Remediation Expenditure:	0.00
FCSAP Care/Maint Expenditur:	0.00
FCSAP Mntring Expenditure:	0.00
Cubic Metres:	0.0000
Hectares:	0.0000
Tons:	0.0000
Closed:	
Class Type:	
Class (EN):	
Class (FR):	
CCME Flag:	
CCME NCS Year:	
Step Name (EN):	
Step Name (FR):	
Planned Compl Date Step7:	
Planned Compl Date Step8:	
Planned Compl Date Step9:	
Total Expenditure Reducing Liabil:	
Created:	
Modified:	
NCSCS Year:	
Reporting Organization (EN):	Fisheries and Oceans Canada
Reporting Organization (FR):	Pêches et Océans Canada

Annual Data

Fiscal Year:	2008-2009
Reporting Organization:	DFO
Highest Step Completed:	03
Total Asmt Expenditure:	23429.00
Total Remediation Expenditure:	0.00
Total Care/Maint Expenditur:	0.00
Total Mntring Expenditure:	0.00
FCSAP Asmt Expenditure:	18508.91
FCSAP Remediation Expenditure:	0.00
FCSAP Care/Maint Expenditur:	0.00
FCSAP Mntring Expenditure:	0.00
Cubic Metres:	0.0000
Hectares:	0.0000
Tons:	0.0000
Closed:	
Class Type:	
Class (EN):	
Class (FR):	
CCME Flag:	
CCME NCS Year:	
Step Name (EN):	
Step Name (FR):	
Planned Compl Date Step7:	
Planned Compl Date Step8:	
Planned Compl Date Step9:	
Total Expenditure Reducing Liabil:	
Created:	
Modified:	
NCSCS Year:	
Reporting Organization (EN):	Fisheries and Oceans Canada
Reporting Organization (FR):	Pêches et Océans Canada

Annual Data

Fiscal Year:	2007-2008
Reporting Organization:	DFO
Highest Step Completed:	01
Total Asmt Expenditure:	817.00
Total Remediation Expenditure:	0.00
Total Care/Maint Expenditur:	0.00
Total Mntring Expenditure:	0.00
FCSAP Asmt Expenditure:	653.60
FCSAP Remediation Expenditure:	0.00
FCSAP Care/Maint Expenditur:	0.00
FCSAP Mntring Expenditure:	0.00
Cubic Metres:	0.0000
Hectares:	0.0000
Tons:	0.0000
Closed:	
Class Type:	
Class (EN):	
Class (FR):	
CCME Flag:	
CCME NCS Year:	
Step Name (EN):	
Step Name (FR):	
Planned Compl Date Step7:	
Planned Compl Date Step8:	

Planned Compl Date Step9:
Total Expenditure Reducing Liabil:
Created:
Modified:
NCSCS Year:
Reporting Organization (EN): Fisheries and Oceans Canada
Reporting Organization (FR): Pêches et Océans Canada

Annual Data

Fiscal Year: 2006-2007
Reporting Organization: DFO
Highest Step Completed: 01
Total Asmt Expenditure: 0.00
Total Remediation Expenditure: 0.00
Total Care/Maint Expenditur: 0.00
Total Mntring Expenditure: 0.00
FCSAP Asmt Expenditure: 0.00
FCSAP Remediation Expenditure: 0.00
FCSAP Care/Maint Expenditur: 0.00
FCSAP Mntring Expenditure: 0.00
Cubic Metres: 0.0000
Hectares: 0.0000
Tons: 0.0000
Closed:
Class Type:
Class (EN):
Class (FR):
CCME Flag:
CCME NCS Year:
Step Name (EN):
Step Name (FR):
Planned Compl Date Step7:
Planned Compl Date Step8:
Planned Compl Date Step9:
Total Expenditure Reducing Liabil:
Created:
Modified:
NCSCS Year:
Reporting Organization (EN): Fisheries and Oceans Canada
Reporting Organization (FR): Pêches et Océans Canada

---

2 | ***1 of 11*** | ***NNE/70.0*** | ***74.8*** | ***CANADIAN COAST GUARD SEARCH & RESCUE STATION PORT WELLER NIAGARA-ON-THE-LAKE ON*** | ***GEN***

Generator No.: ON0196514
Status:
Approval Years: 96,97
Contam. Facility:
MHSW Facility:
SIC Code: 8125
SIC Description: REGULATORY SERV.

PO Box No.:
Country:
Choice of Contact:
Co Admin:
Phone No. Admin:

--Details--
Waste Code: 221
Waste Description: LIGHT FUELS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

---

2 **2 of 11** **NNE/70.0** **74.8**

CANADIAN COAST GUARD
SEARCH & RESCUE STATION PORT WELLER
C/O ST. LAWRENCE SEAWAY AUTHORITY
NIAGARA-ON-THE-LAKE ON L2R 6V8

GEN

Generator No.: ON0196514
Status:
Approval Years: 98,99,00,01
Contam. Facility:
MHSW Facility:
SIC Code: 8125
SIC Description: REGULATORY SERV.

PO Box No.:
Country:
Choice of Contact:
Co Admin:
Phone No. Admin:

--Details--
Waste Code: 221
Waste Description: LIGHT FUELS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

---

2 **3 of 11** **NNE/70.0** **74.8**

CANADIAN COAST GUARD
SEARCH & RESCUE STATION PORT WELLER
End of the West Pier, Lock 1
St. Catharines ON L2R 6V8

GEN

Generator No.: ON0196514
Status:
Approval Years: 02,03,04,05,06,07,08
Contam. Facility:
MHSW Facility:
SIC Code:
SIC Description:

PO Box No.:
Country:
Choice of Contact:
Co Admin:
Phone No. Admin:

--Details--
Waste Code: 221
Waste Description: LIGHT FUELS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

---

2 **4 of 11** **NNE/70.0** **74.8**

CANADIAN COAST GUARD
SEARCH & RESCUE STATION PORT WELLER
End of the West Pier, Lock 1
St. Catharines ON

GEN

Generator No.: ON0196514
Status:
Approval Years: 2009
Contam. Facility:

PO Box No.:
Country:
Choice of Contact:
Co Admin:

Map Key	Number of Records	Direction/ Distance (m)	Elevation (m)	Site	DB

MHSW Facility: ***Phone No. Admin:***
SIC Code: 911240
SIC Description: Federal Regulatory Services

--Details--
Waste Code: 221
Waste Description: LIGHT FUELS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

---

2 ***5 of 11*** ***NNE/70.0*** ***74.8***

CANADIAN COAST GUARD
SEARCH & RESCUE STATION PORT WELLER
End of the West Pier, Lock 1
St. Catharines ON

GEN

Generator No.: ON0196514 ***PO Box No.:***
Status: ***Country:***
Approval Years: 2010 ***Choice of Contact:***
Contam. Facility: ***Co Admin:***
MHSW Facility: ***Phone No. Admin:***
SIC Code: 911240
SIC Description: Federal Regulatory Services

--Details--
Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

Waste Code: 221
Waste Description: LIGHT FUELS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

---

2 ***6 of 11*** ***NNE/70.0*** ***74.8***

CANADIAN COAST GUARD
SEARCH & RESCUE STATION PORT WELLER
End of the West Pier, Lock 1
St. Catharines ON

GEN

Generator No.: ON0196514 ***PO Box No.:***
Status: ***Country:***
Approval Years: 2011 ***Choice of Contact:***
Contam. Facility: ***Co Admin:***
MHSW Facility: ***Phone No. Admin:***
SIC Code: 911240
SIC Description: Federal Regulatory Services

--Details--
Waste Code: 221
Waste Description: LIGHT FUELS

Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Map Key	Number of Records	Direction/ Distance (m)	Elevation (m)	Site	DB
2	7 of 11	NNE/70.0	74.8	CANADIAN COAST GUARD SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON	GEN

Generator No.: ON0196514
Status:
Approval Years: 2013
Contam. Facility:
MHSW Facility:
SIC Code: 911240
SIC Description:

PO Box No.:
Country:
Choice of Contact:
Co Admin:
Phone No. Admin:

--Details--
Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Waste Code: 221
Waste Description: LIGHT FUELS

Map Key	Number of Records	Direction/ Distance (m)	Elevation (m)	Site	DB
2	8 of 11	NNE/70.0	74.8	CANADIAN COAST GUARD Port Weller Coast Guard Station End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	GEN

Generator No.: ON0196514
Status:
Approval Years: 2016
Contam. Facility: No
MHSW Facility: No
SIC Code: 911290
SIC Description: 911290

PO Box No.:
Country: Canada
Choice of Contact: CO_ADMIN
Co Admin: Scott Mabee
Phone No. Admin: 905 934-2446 Ext.

--Details--
Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

Waste Code: 221
Waste Description: LIGHT FUELS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Map Key	Number of Records	Direction/ Distance (m)	Elevation (m)	Site	DB
2	9 of 11	NNE/70.0	74.8	CANADIAN COAST GUARD SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines ON L2R 6V8	GEN

Generator No.: ON0196514
Status:
Approval Years: 2015
Contam. Facility: No
MHSW Facility: No
SIC Code: 911240
SIC Description: 911240

PO Box No.:
Country: Canada
Choice of Contact: CO_OFFICIAL
Co Admin: Lawrence W Trudell
Phone No. Admin: 905-934-2446 Ext.

Map Key	Number of Records	Direction/ Distance (m)	Elevation (m)	Site	DB

--Details--
Waste Code: 221
Waste Description: LIGHT FUELS

Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

---

2 | ***10 of 11*** | ***NNE/70.0*** | ***74.8*** | ***GEN***

CANADIAN COAST GUARD
SEARCH & RESCUE STATION PORT WELLER
End of the West Pier, Lock 1
St. Catharines ON L2R 6V8

Generator No.: ON0196514
Status:
Approval Years: 2014
Contam. Facility: No
MHSW Facility: No
SIC Code: 911240
SIC Description: 911240

PO Box No.:
Country: Canada
Choice of Contact: CO_OFFICIAL
Co Admin: David McGinnis
Phone No. Admin: 905-934-2446 Ext.

--Details--
Waste Code: 251
Waste Description: OIL SKIMMINGS & SLUDGES

Waste Code: 252
Waste Description: WASTE OILS & LUBRICANTS

Waste Code: 221
Waste Description: LIGHT FUELS

---

2 | ***11 of 11*** | ***NNE/70.0*** | ***74.8*** | ***GEN***

CANADIAN COAST GUARD Search & Rescue
Port Weller Coast Guard Station End of the West Pier, Lock 1
St. Catharines ON L2R 6V8

Generator No.: ON0196514
Status: Registered
Approval Years: As of Jun 2017
Contam. Facility:
MHSW Facility:
SIC Code:
SIC Description:

PO Box No.:
Country: Canada
Choice of Contact:
Co Admin:
Phone No. Admin:

--Details--
Waste Code: 252 L
Waste Description: Waste crankcase oils and lubricants

Waste Code: 251 L
Waste Description: Waste oils/sludges (petroleum based)

Waste Code: 221 I
Waste Description: Light fuels

---

3 | ***1 of 1*** | ***NNE/76.2*** | ***74.8*** | ***EHS***

Government Road West
St. Catharines ON

Postal Code:	
City:	
Address2:	
Address1:	
Provstate:	
Order No.:	20080820019
Addit. Info Ordered::	Fire Insur. Maps And /or Site Plans
Report Date:	8/21/2008
Report Type:	Site Report
Search Radius (km):	0.25

Unplottable Summary

Total: 3 Unplottable sites

DB	Company Name/Site Name	Address	City	Postal
ECA	The Regional Municipality of Niagara	Welland Canals Parkway	St. Catharines ON	L2V 4T7
EHS		Welland Canals Pky	St. Catharines ON	
SPL	Canadian Coast Guard<UNOFFICIAL>	Port Dalhousie anchor area	St. Catharines ON	

Unplottable Report

Site: ***The Regional Municipality of Niagara***
Welland Canals Parkway St. Catharines ON L2V 4T7

Database: ***ECA***

Approval No:	8445-7RXM6A	***SWP Area Name:***	
Status:	Approved	***MOE District:***	
Date:	2009-05-12	***City:***	
Record Type:	ECA	***Latitude:***	
Link Source:	IDS	***Longitude:***	
Project Type:	Municipal Drinking Water Systems		
Approval Type:	ECA-Municipal Drinking Water Systems		
Full Address:			
Full PDF Link:			

Site:
Welland Canals Pky St. Catharines ON

Database: ***EHS***

Postal Code:	
City:	
Address2:	
Address1:	
Provstate:	
Order No.:	20130403037
Addit. Info Ordered::	
Report Date:	04-APR-13
Report Type:	Site Report
Search Radius (km):	.001

Site: ***Canadian Coast Guard<UNOFFICIAL>***
Port Dalhousie anchor area St. Catharines ON

Database: ***SPL***

Ref No:	3041-8ZBMKQ	***Site Address:***	Port Dalhousie anchor area
Contaminant Name:	HYDRAULIC OIL	***Site Conc:***	
Contaminant Code:	15	***Site Lot:***	
Contaminant Limit 1:		***Site County/District:***	
Contam. Limit Freq 1:		***Site Municipality:***	St. Catharines
Contaminant UN No 1:		***Site Postal Code:***	
Contaminant Qty:	.55 L	***Sector Type:***	Watercraft/Vessel
MOE Reported Dt:	22-OCT-12	***Source Type:***	
Health/Env Conseq:		***Receiving Medium:***	
Incident Dt:	22-OCT-12	***Receiving Env:***	
Incident Cause:	Process Upset/Malfunction	***Environment Impact:***	Not Anticipated
Incident Event:		***Nature of Impact:***	Surface Water Pollution
Incident Reason:	Unknown / N/A	***SAC Action Class:***	Watercourse Spills
Incident Summary:	Vessel: AnDean hyd oil to water. 150 grams. Port Dalhousie		

Appendix: Database Descriptions

Environmental Risk Information Services (ERIS) can search the following databases. The extent of historical information varies with each database and current information is determined by what is publicly available to ERIS at the time of update. ***Note:*** *Databases denoted with " * " indicates that the database will no longer be updated. See the individual database description for more information.*

Abandoned Aggregate Inventory: Provincial AAGR

The MAAP Program maintains a database of abandoned pits and quarries. Please note that the database is only referenced by lot and concession and city/town location. The database provides information regarding the location, type, size, land use, status and general comments.*

Government Publication Date: Sept 2002*

Aggregate Inventory: Provincial AGR

The Ontario Ministry of Natural Resources maintains a database of all active pits and quarries. The database provides information regarding the registered owner/operator, location name, operation type, approval type, and maximum annual tonnage.

Government Publication Date: Up to Sep 2017

Abandoned Mine Information System: Provincial AMIS

The Abandoned Mines Information System contains data on known abandoned and inactive mines located on both Crown and privately held lands. The information was provided by the Ministry of Northern Development and Mines (MNDM), with the following disclaimer: "the database provided has been compiled from various sources, and the Ministry of Northern Development and Mines makes no representation and takes no responsibility that such information is accurate, current or complete". Reported information includes official mine name, status, background information, mine start/end date, primary commodity, mine features, hazards and remediation.

Government Publication Date: 1800-Nov 2016

Anderson's Waste Disposal Sites: Private ANDR

The information provided in this database was collected by examining various historical documents which aimed to characterize the likely position of former waste disposal sites from 1860 to present. The research initiative behind the creation of this database was to identify those sites that are missing from the Ontario MOE Waste Disposal Site Inventory, as well as to provide revisions and corrections to the positions and descriptions of sites currently listed in the MOE inventory. In addition to historic waste disposal facilities, the database also identifies certain auto wreckers and scrap yards that have been extrapolated from documentary sources. Please note that the data is not warranted to be complete, exhaustive or authoritative. The information was collected for research purposes only.

Government Publication Date: 1860s-Present

Automobile Wrecking & Supplies: Private AUWR

This database provides an inventory of known locations that are involved in the scrap metal, automobile wrecking/recycling, and automobile parts & supplies industry. Information is provided on the company name, location and business type.

Government Publication Date: 1999-May 2017

Borehole: Provincial BORE

A borehole is the generalized term for any narrow shaft drilled in the ground, either vertically or horizontally. The information here includes geotechnical investigations or environmental site assessments, mineral exploration, or as a pilot hole for installing piers or underground utilities. Information is from many sources such as the Ministry of Transportation (MTO) boreholes from engineering reports and projects from the 1950 to 1990's in Southern Ontario. Boreholes from the Ontario Geological Survey (OGS) including The Urban Geology Analysis Information System (UGAIS) and the York Peel Durham Toronto (YPDT) database of the Conservation Authority Moraine Coalition. This database will include fields such as location, stratigraphy, depth, elevation, year drilled, etc. For all water well data or oil and gas well data for Ontario please refer to WWIS and OOGW.

Government Publication Date: 1875-Jul 2014

Certificates of Approval: Provincial CA

This database contains the following types of approvals: Air & Noise, Industrial Sewage, Municipal & Private Sewage, Waste Management Systems and Renewable Energy Approvals. The MOE in Ontario states that any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste, must have a Certificate of Approval before it can operate lawfully. Fields include approval number, business name, address, approval date, approval type and status. This database will no longer be updated, as CofA's have been replaced by either Environmental Activity and Sector Registry (EASR) or Environmental Compliance Approval (ECA). Please refer to those individual databases for any information after Oct.31, 2011.

Government Publication Date: 1985-Oct 30, 2011*

Commercial Fuel Oil Tanks: Provincial CFOT

Since May 2002, Ontario developed a new act where it became mandatory for fuel oil tanks to be registered with Technical Standards & Safety Authority (TSSA). This data would include all commercial underground fuel oil tanks in Ontario with fields such as location, registration number, tank material, age of tank and tank size.

Government Publication Date: Feb 28, 2017

Chemical Register: Private CHEM

This database includes information from both a one time study conducted in 1992 and private source and is a listing of facilities that manufacture or distribute chemicals. The production of these chemical substances may involve one or more chemical reactions and/or chemical separation processes (i.e. fractionation, solvent extraction, crystallization, etc.).

Government Publication Date: 1999-May 2017

Compressed Natural Gas Stations: Private CNG

Canada has a network of public access compressed natural gas (CNG) refuelling stations. These stations dispense natural gas in compressed form at 3,000 pounds per square inch (psi), the pressure which is allowed within the current Canadian codes and standards. The majority of natural gas refuelling is located at existing retail gasoline that have a separate refuelling island for natural gas. This list of stations is made available by the Canadian Natural Gas Vehicle Alliance.

Government Publication Date: Dec 31, 2012

Inventory of Coal Gasification Plants and Coal Tar Sites: Provincial COAL

This inventory includes both the "Inventory of Coal Gasification Plant Waste Sites in Ontario-April 1987" and the Inventory of Industrial Sites Producing or Using Coal Tar and Related Tars in Ontario-November 1988) collected by the MOE. It identifies industrial sites that produced and continue to produce or use coal tar and other related tars. Detailed information is available and includes: facility type, size, land use, information on adjoining properties, soil condition, site operators/occupants, site description, potential environmental impacts and historic maps available. This was a one-time inventory.*

Government Publication Date: Apr 1987 and Nov 1988*

Compliance and Convictions: Provincial CONV

This database summarizes the fines and convictions handed down by the Ontario courts beginning in 1989. Companies and individuals named here have been found guilty of environmental offenses in Ontario courts of law.

Government Publication Date: 1989-Sep 2017

Certificates of Property Use: Provincial CPU

This is a subset taken from Ontario's Environmental Registry (EBR) database. It will include all CPU's on the registry such as (EPA s. 168.6) - Certificate of Property Use.

Government Publication Date: 1994-Oct 2017

Drill Hole Database: Provincial DRL

The Ontario Drill Hole Database contains information on more than 113,000 percussion, overburden, sonic and diamond drill holes from assessment files on record with the department of Mines and Minerals. Please note that limited data is available for southern Ontario, as it was the last area to be completed. The database was created when surveys submitted to the Ministry were converted in the Assessment File Research Image Database (AFRI) project. However, the degree of accuracy (coordinates) as to the exact location of drill holes is dependent upon the source document submitted to the MNDM. Levels of accuracy used to locate holes are: centering on the mining claim; a sketch of the mining claim; a 1:50,000 map; a detailed company map; or from submitted a "Report of Work".

Government Publication Date: 1886-Aug 2015

Environmental Activity and Sector Registry: Provincial EASR

On October 31, 2011, a smarter, faster environmental approvals system came into effect in Ontario. The EASR allows businesses to register certain activities with the ministry, rather than apply for an approval. The registry is available for common systems and processes, to which preset rules of operation can be applied. The EASR is currently available for: heating systems, standby power systems and automotive refinishing. Businesses whose activities aren't subject to the EASR may apply for an ECA (Environmental Compliance Approval), Please see our ECA database.

Government Publication Date: Oct 2011-Oct 2017

Environmental Registry: Provincial EBR

The Environmental Registry lists proposals, decisions and exceptions regarding policies, Acts, instruments, or regulations that could significantly affect the environment. Through the Registry, thirteen provincial ministries notify the public of upcoming proposals and invite their comments. For example, if a local business is requesting a permit, license, or certificate of approval to release substances into the air or water; these are notified on the registry. Data includes: Approval for discharge into the natural environment other than water (i.e. Air) - EPA s. 9, Approval for sewage works - OWRA s. 53(1), and EPA s. 27 - Approval for a waste disposal site. For information regarding Permit to Take Water (PTTW), Certificate of Property Use (CPU) and (ORD) Orders please refer to those individual databases.

Government Publication Date: 1994-Oct 2017

Environmental Compliance Approval: Provincial ECA

On October 31, 2011, a smarter, faster environmental approvals system came into effect in Ontario. In the past, a business had to apply for multiple approvals (known as certificates of approval) for individual processes and pieces of equipment. Today, a business either registers itself, or applies for a single approval, depending on the types of activities it conducts. Businesses whose activities aren't subject to the EASR may apply for an ECA. A single ECA addresses all of a business's emissions, discharges and wastes. Separate approvals for air, noise and waste are no longer required. This database will also include Renewable Energy Approvals. For certificates of approval prior to Nov 1st, 2011, please refer to the CA database. For all Waste Disposal Sites please refer to the WDS database.

Government Publication Date: Oct 2011-Oct 2017

Environmental Effects Monitoring: Federal EEM

The Environmental Effects Monitoring program assesses the effects of effluent from industrial or other sources on fish, fish habitat and human usage of fisheries resources. Since 1992, pulp and paper mills have been required to conduct EEM studies under the Pulp and Paper Effluent Regulations. This database provides information on the mill name, geographical location and sub-lethal toxicity data.

Government Publication Date: 1992-2007*

ERIS Historical Searches: Private EHS

ERIS has compiled a database of all environmental risk reports completed since March 1999. Available fields for this database include: site location, date of report, type of report, and search radius. As per all other databases, the ERIS database can be referenced on both the map and "Statistical Profile" page.

Government Publication Date: 1999-Aug 2016

Environmental Issues Inventory System: Federal EIIS

The Environmental Issues Inventory System was developed through the implementation of the Environmental Issues and Remediation Plan. This plan was established to determine the location and severity of contaminated sites on inhabited First Nation reserves, and where necessary, to remediate those that posed a risk to health and safety; and to prevent future environmental problems. The EIIS provides information on the reserve under investigation, inventory number, name of site, environmental issue, site action (Remediation, Site Assessment), and date investigation completed.

Government Publication Date: 1992-2001*

Emergency Management Historical Event: Provincial EMHE

List of locations of historical occurrences of emergency events, including those assigned to the Ministry of Natural Resources by Order-In-Council (OIC) under the Emergency Management and Civil Protection Act, as well as events where MNR provided requested emergency response assistance. Many of these events will have involved community evacuations, significant structural loss, and/or involvement of MNR emergency response staff. These events fall into one of ten (10) type categories: Dam Failure; Drought / Low Water; Erosion; Flood; Forest Fire; Soil and Bedrock Instability; Petroleum Resource Center Event, EMO Requested Assistance, Continuity of Operations Event, Other Requested Assistance. EMHE record details are reproduced by ERIS under License with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2017.

Government Publication Date: Dec 31, 2016

List of TSSA Expired Facilities: Provincial EXP

List of facilities with removed tanks which were once registered with the Fuels Safety Program of the Technical Standards and Safety Authority (TSSA). Includes private fuel outlets, bulk plants, fuel oil tanks, gasoline stations, marinas, propane filling stations, liquid fuel tanks, piping systems, etc. Tanks which have been removed automatically fall under the expired facilities inventory held by TSSA.

Government Publication Date: Feb 28, 2017

Federal Convictions: Federal FCON

Environment Canada maintains a database referred to as the "Environmental Registry" that details prosecutions under the Canadian Environmental Protection Act (CEPA) and the Fisheries Act (FA). Information is provided on the company name, location, charge date, offence and penalty.

Government Publication Date: 1988-Jun 2007*

Contaminated Sites on Federal Land: Federal FCS

The Federal Contaminated Sites Inventory includes information on known federal contaminated sites under the custodianship of departments, agencies and consolidated Crown corporations as well as those that are being or have been investigated to determine whether they have contamination arising from past use that could pose a risk to human health or the environment. The inventory also includes non-federal contaminated sites for which the Government of Canada has accepted some or all financial responsibility. It does not include sites where contamination has been caused by, and which are under the control of, enterprise Crown corporations, private individuals, firms or other levels of government.

Government Publication Date: Jun 2000-Mar 2017

Fisheries & Oceans Fuel Tanks: Federal FOFT

Fisheries & Oceans Canada maintains an inventory of aboveground & underground fuel storage tanks located on Fisheries & Oceans property or controlled by DFO. Our inventory provides information on the site name, location, tank owner, tank operator, facility type, storage tank location, tank contents & capacity, and date of tank installation.

Government Publication Date: 1964-Apr 2015

Fuel Storage Tank: Provincial FST

The Technical Standards & Safety Authority (TSSA), under the Technical Standards & Safety Act of 2000 maintains a database of registered private and retail fuel storage tanks in Ontario with fields such as location, tank status, license date, tank type, tank capacity, fuel type, installation year and facility type.

Government Publication Date: Feb 28, 2017

Fuel Storage Tank - Historic: Provincial FSTH

The Fuels Safety Branch of the Ontario Ministry of Consumer and Commercial Relations maintained a database of all registered private fuel storage tanks. Public records of private fuel storage tanks are only available since the registration became effective in September 1989. This information is now collected by the Technical Standards and Safety Authority.

Government Publication Date: Pre-Jan 2010*

Ontario Regulation 347 Waste Generators Summary: Provincial GEN

Regulation 347 of the Ontario EPA defines a waste generation site as any site, equipment and/or operation involved in the production, collection, handling and/or storage of regulated wastes. A generator of regulated waste is required to register the waste generation site and each waste produced, collected, handled, or stored at the site. This database contains the registration number, company name and address of registered generators including the types of hazardous wastes generated. It includes data on waste generating facilities such as: drycleaners, waste treatment and disposal facilities, machine shops, electric power distribution etc. This information is a summary of all years from 1986 including the most currently available data. Some records may contain, within the company name, the phrase "See & Use..." followed by a series of letters and numbers. This occurs when one company is amalgamated with or taken over by another registered company. The number listed as "See & Use", refers to the new ownership and the other identification number refers to the original ownership. This phrase serves as a link between the 2 companies until operations have been fully transferred.

Government Publication Date: 1986-Jun 2017

Greenhouse Gas Emissions from Large Facilities: Federal GHG

List of greenhouse gas emissions from large facilities made available by Environment Canada. Greenhouse gas emissions in kilotonnes of carbon dioxide equivalents (kt CO2 eq).

Government Publication Date: 2013-Dec 2015

TSSA Historic Incidents: Provincial HINC

This database will cover all incidences recorded by TSSA with their older system, before they moved to their new management system. TSSA's Fuels Safety Program administers the Technical Standards & Safety Act 2000, providing fuel-related safety services associated with the safe transportation, storage, handling and use of fuels such as gasoline, diesel, propane, natural gas and hydrogen. Under this Act, TSSA regulates fuel suppliers, storage facilities, transport trucks, pipelines, contractors and equipment or appliances that use fuels. The TSSA works to protect the public, the environment and property from fuel-related hazards such as spills, fires and explosions. This database will include spills and leaks from pipelines, diesel, fuel oil, gasoline, natural gas, propane and hydrogen recorded by the TSSA.

Government Publication Date: 2006-June 2009*

Indian & Northern Affairs Fuel Tanks: Federal IAFT

The Department of Indian & Northern Affairs Canada (INAC) maintains an inventory of aboveground & underground fuel storage tanks located on both federal and crown land. Our inventory provides information on the reserve name, location, facility type, site/facility name, tank type, material & ID number, tank contents & capacity, and date of tank installation.

Government Publication Date: 1950-Aug 2003*

TSSA Incidents: Provincial INC

TSSA's Fuels Safety Program administers the Technical Standards & Safety Act 2000, providing fuel-related safety services associated with the safe transportation, storage, handling and use of fuels such as gasoline, diesel, propane, natural gas and hydrogen. Under this Act, TSSA regulates fuel suppliers, storage facilities, transport trucks, pipelines, contractors and equipment or appliances that use fuels. Includes incidents from fuel-related hazards such as spills, fires and explosions. This database will include spills and leaks from diesel, fuel oil, gasoline, natural gas, propane and hydrogen recorded by the TSSA.

Government Publication Date: Feb 28, 2017

Landfill Inventory Management Ontario: Provincial LIMO

The Landfill Inventory Management Ontario (LIMO) database is updated every year, as the ministry compiles new and updated information. The inventory will include small and large landfills. Additionally, each year the ministry will request operators of the larger landfills complete a landfill data collection form that will be used to update LIMO and will include the following information from the previous operating year. This will include additional information such as estimated amount of total waste received, landfill capacity, estimated total remaining landfill capacity, fill rates, engineering designs, reporting and monitoring details, size of location, service area, approved waste types, leachate of site treatment, contaminant attenuation zone and more. The small landfills will include information such as site owner, site location and certificate of approval # and status.

Government Publication Date: Dec 31, 2013

Canadian Mine Locations: Private MINE

This information is collected from the Canadian & American Mines Handbook. The Mines database is a national database that provides over 290 listings on mines (listed as public companies) dealing primarily with precious metals and hard rocks. Listed are mines that are currently in operation, closed, suspended, or are still being developed (advanced projects). Their locations are provided as geographic coordinates (x, y and/or longitude, latitude). As of 2002, data pertaining to Canadian smelters and refineries has been appended to this database.

Government Publication Date: 1998-2009*

Mineral Occurrences: Provincial MNR

In the early 70's, the Ministry of Northern Development and Mines created an inventory of approximately 19,000 mineral occurrences in Ontario, in regard to metallic and industrial minerals, as well as some information on building stones and aggregate deposits. Please note that the "Horizontal Positional Accuracy" is approximately +/- 200 m. Many reference elements for each record were derived from field sketches using pace or chain/tape measurements against claim posts or topographic features in the area. The primary limiting factor for the level of positional accuracy is the scale of the source material. The testing of horizontal accuracy of the source materials was accomplished by comparing the plan metric (X and Y) coordinates of that point with the coordinates of the same point as defined from a source of higher accuracy.

Government Publication Date: 1846-Feb 2017

National Analysis of Trends in Emergencies System (NATES): Federal NATE

In 1974 Environment Canada established the National Analysis of Trends in Emergencies System (NATES) database, for the voluntary reporting of significant spill incidents. The data was to be used to assist in directing the work of the emergencies program. NATES ran from 1974 to 1994. Extensive information is available within this database including company names, place where the spill occurred, date of spill, cause, reason and source of spill, damage incurred, and amount, concentration, and volume of materials released.

Government Publication Date: 1974-1994*

Non-Compliance Reports: Provincial NCPL

The Ministry of the Environment provides information about non-compliant discharges of contaminants to air and water that exceed legal allowable limits, from regulated industrial and municipal facilities. A reported non-compliance failure may be in regard to a Control Order, Certificate of Approval, Sectoral Regulation or specific regulation/act.

Government Publication Date: Dec 31, 2014

National Defense & Canadian Forces Fuel Tanks: Federal NDFT

The Department of National Defense and the Canadian Forces maintains an inventory of all aboveground & underground fuel storage tanks located on DND lands. Our inventory provides information on the base name, location, tank type & capacity, tank contents, tank class, date of tank installation, date tank last used, and status of tank as of May 2001. This database will no longer be updated due to the new National Security protocols which have prohibited any release of this database.

Government Publication Date: Up to May 2001*

National Defense & Canadian Forces Spills: Federal NDSP

The Department of National Defense and the Canadian Forces maintains an inventory of spills to land and water. All spill sites have been classified under the "Transportation of Dangerous Goods Act - 1992". Our inventory provides information on the facility name, location, spill ID #, spill date, type of spill, as well as the quantity of substance spilled & recovered.

Government Publication Date: Mar 1999-Aug 2010

National Defence & Canadian Forces Waste Disposal Sites: Federal NDWD

The Department of National Defence and the Canadian Forces maintains an inventory of waste disposal sites located on DND lands. Where available, our inventory provides information on the base name, location, type of waste received, area of site, depth of site, year site opened/closed and status.

Government Publication Date: 2001-Apr 2007*

National Energy Board Pipeline Incidents: Federal NEBI

Locations of pipeline incidents from 2008 to present, made available by the National Energy Board (NEB). Includes incidents reported under the Onshore Pipeline Regulations and the Processing Plant Regulations related to pipelines under federal jurisdiction, does not include incident data related to pipelines under provincial or territorial jurisdiction.

Government Publication Date: 2008 -Jun 2017

National Energy Board Wells: Federal NEBW

The NEBW database contains information on onshore & offshore oil and gas wells that are outside provincial jurisdiction(s) and are thereby regulated by the National Energy Board. Data is provided regarding the operator, well name, well ID No./UWI, status, classification, well depth, spud and release date.

Government Publication Date: 1920-Feb 2003*

National Environmental Emergencies System (NEES): Federal NEES

In 2000, the Emergencies program implemented NEES, a reporting system for spills of hazardous substances. For the most part, this system only captured data from the Atlantic Provinces, some from Quebec and Ontario and a portion from British Columbia. Data for Alberta, Saskatchewan, Manitoba and the Territories was not captured. However, NEES is also a repository for previous Environment Canada spill datasets. NEES is composed of the historic datasets ' or Trends ' which dates from approximately 1974 to present. NEES Trends is a compilation of historic databases, which were merged and includes data from NATES (National Analysis of Trends in Emergencies System), ARTS (Atlantic Regional Trends System), and NEES. In 2001, the Emergencies Program determined that variations in reporting regimes and requirements between federal and provincial agencies made national spill reporting and trend analysis difficult to achieve. As a consequence, the department has focused efforts on capturing data on spills of substances which fall under its legislative authority only (CEPA and FA). As such, the NEES database will be decommissioned in December 2004.

Government Publication Date: 1974-2003*

National PCB Inventory: Federal NPCB

Environment Canada's National PCB inventory includes information on in-use PCB containing equipment in Canada including federal, provincial and private facilities. Federal out-of-service PCB containing equipment and PCB waste owned by the federal government or by federally regulated industries such as airlines, railway companies, broadcasting companies, telephone and telecommunications companies, pipeline companies, etc. are also listed. Although it is not Environment Canada's mandate to collect data on non-federal PCB waste, the National PCB inventory includes some information on provincial and private PCB waste and storage sites. Some addresses provided may be Head Office addresses and are not necessarily the location of where the waste is being used or stored.

Government Publication Date: 1988-2008*

National Pollutant Release Inventory: Federal NPRI

Environment Canada has defined the National Pollutant Release Inventory ("NPRI") as a federal government initiative designed to collect comprehensive national data regarding releases to air, water, or land, and waste transfers for recycling for more than 300 listed substances.

Government Publication Date: 1993-May 2017

Oil and Gas Wells: Private OGW

The Nickle's Energy Group (publisher of the Daily Oil Bulletin) collects information on drilling activity including operator and well statistics. The well information database includes name, location, class, status and depth. The main Nickle's database is updated on a daily basis, however, this database is updated on a monthly basis. More information is available at www.nickles.com.

Government Publication Date: 1988-Sep 2017

Ontario Oil and Gas Wells: Provincial OOGW

In 1998, the MNR handed over to the Ontario Oil, Gas and Salt Resources Corporation, the responsibility of maintaining a database of oil and gas wells drilled in Ontario. The OGSR Library has over 20,000+ wells in their database. Information available for all wells in the ERIS database include well owner/operator, location, permit issue date, and well cap date, license No., status, depth and the primary target (rock unit) of the well being drilled. All geology/stratigraphy table information, plus all water table information is also provide for each well record.

Government Publication Date: 1800-Oct 2017

Inventory of PCB Storage Sites: Provincial OPCB

The Ontario Ministry of Environment, Waste Management Branch, maintains an inventory of PCB storage sites within the province. Ontario Regulation 11/82 (Waste Management - PCB) and Regulation 347 (Generator Waste Management) under the Ontario EPA requires the registration of inactive PCB storage equipment and/or disposal sites of PCB waste with the Ontario Ministry of Environment. This database contains information on: 1) waste quantities; 2) major and minor sites storing liquid or solid waste; and 3) a waste storage inventory.

Government Publication Date: 1987-Oct 2004; 2012-Dec 2013

Orders: Provincial ORD

This is a subset taken from Ontario's Environmental Registry (EBR) database. It will include all Orders on the registry such as (EPA s. 17) - Order for remedial work, (EPA s. 18) - Order for preventative measures, (EPA s. 43) - Order for removal of waste and restoration of site, (EPA s. 44) - Order for conformity with Act for waste disposal sites, (EPA s. 136) - Order for performance of environmental measures.

Government Publication Date: 1994-Oct 2017

Canadian Pulp and Paper: Private PAP

This information is part of the Pulp and Paper Canada Directory. The Directory provides a comprehensive listing of the locations of pulp and paper mills and the products that they produce.

Government Publication Date: 1999, 2002, 2004, 2005, 2009

Parks Canada Fuel Storage Tanks: Federal PCFT

Canadian Heritage maintains an inventory of known fuel storage tanks operated by Parks Canada, in both National Parks and at National Historic Sites. The database details information on site name, location, tank install/removal date, capacity, fuel type, facility type, tank design and owner/operator.

Government Publication Date: 1920-Jan 2005*

Pesticide Register: Provincial PES

The Ontario Ministry of the Environment and Climate Change maintains a database of licensed operators and vendors of registered pesticides.

Government Publication Date: 1988-Aug 2017

TSSA Pipeline Incidents: Provincial PINC

TSSA's Fuels Safety Program administers the Technical Standards & Safety Act 2000, providing fuel-related safety services associated with the safe transportation, storage, handling and use of fuels such as gasoline, diesel, propane, natural gas and hydrogen. Under this Act, TSSA regulates fuel suppliers, storage facilities, transport trucks, pipelines, contractors and equipment or appliances that use fuels. This database will include spills, strike and leaks from recorded by the TSSA.

Government Publication Date: Feb 28, 2017

Private and Retail Fuel Storage Tanks: Provincial PRT

The Fuels Safety Branch of the Ontario Ministry of Consumer and Commercial Relations maintained a database of all registered private fuel storage tanks and licensed retail fuel outlets. This database includes an inventory of locations that have gasoline, oil, waste oil, natural gas and/or propane storage tanks on their property. The MCCR no longer collects this information. This information is now collected by the Technical Standards and Safety Authority (TSSA).

Government Publication Date: 1989-1996*

Permit to Take Water: Provincial PTTW

This is a subset taken from Ontario's Environmental Registry (EBR) database. It will include all PTTW's on the registry such as OWRA s. 34 - Permit to take water.

Government Publication Date: 1994-Oct 2017

Ontario Regulation 347 Waste Receivers Summary: Provincial REC

Part V of the Ontario Environmental Protection Act ("EPA") regulates the disposal of regulated waste through an operating waste management system or a waste disposal site operated or used pursuant to the terms and conditions of a Certificate of Approval or a Provisional Certificate of Approval. Regulation 347 of the Ontario EPA defines a waste receiving site as any site or facility to which waste is transferred by a waste carrier. A receiver of regulated waste is required to register the waste receiving facility. This database represents registered receivers of regulated wastes, identified by registration number, company name and address, and includes receivers of waste such as: landfills, incinerators, transfer stations, PCB storage sites, sludge farms and water pollution control plants. This information is a summary of all years from 1986 including the most currently available data.

Government Publication Date: 1986-2016

Record of Site Condition: Provincial RSC

The Record of Site Condition (RSC) is part of the Ministry of the Environment's Brownfields Environmental Site Registry. Protection from environmental cleanup orders for property owners is contingent upon documentation known as a record of site condition (RSC) being filed in the Environmental Site Registry. In order to file an RSC, the property must have been properly assessed and shown to meet the soil, sediment and groundwater standards appropriate for the use (such as residential) proposed to take place on the property. The Record of Site Condition Regulation (O. Reg. 153/04) details requirements related to site assessment and clean up.
RSCs filed after July 1, 2011 will also be included as part of the new (O.Reg. 511/09).

Government Publication Date: 1997-Sept 2001, Oct 2004-Aug 2017

Retail Fuel Storage Tanks: Private RST

This database includes an inventory of retail fuel outlet locations (including marinas) that have on their property gasoline, oil, waste oil, natural gas and / or propane storage tanks.

Government Publication Date: 1999-May 2017

Scott's Manufacturing Directory: Private SCT

Scott's Directories is a data bank containing information on over 200,000 manufacturers across Canada. Even though Scott's listings are voluntary, it is the most comprehensive database of Canadian manufacturers available. Information concerning a company's address, plant size, and main products are included in this database.

Government Publication Date: 1992-Mar 2011*

Ontario Spills: Provincial SPL

This database identifies information such as location (approximate), type and quantity of contaminant, date of spill, environmental impact, cause, nature of impact, etc. Information from 1988-2002 was part of the ORIS (Occurrence Reporting Information System). The SAC (Spills Action Centre) handles all spills reported in Ontario. Regulations for spills in Ontario are part of the MOE's Environmental Protection Act, Part X.

Government Publication Date: 1988-Jun 2017

Wastewater Discharger Registration Database: Provincial SRDS

Information under this heading is combination of the following 2 programs. The Municipal/Industrial Strategy for Abatement (MISA) division of the Ontario Ministry of Environment maintained a database of all direct dischargers of toxic pollutants within nine sectors including: Electric Power Generation; Mining; Petroleum Refining; Organic Chemicals; Inorganic Chemicals; Pulp & Paper; Metal Casting; Iron & Steel; and Quarries. All sampling information is now collected and stored within the Sample Result Data Store (SRDS).

Government Publication Date: 1990-2014

Anderson's Storage Tanks: Private TANK

The information provided in this database was collected by examining various historical documents, which identified the location of former storage tanks, containing substances such as fuel, water, gas, oil, and other various types of miscellaneous products. Information is available in regard to business operating at tank site, tank location, permit year, permit & installation type, no. of tanks installed & configuration and tank capacity. Data contained within this database pertains only to the city of Toronto and is not warranted to be complete, exhaustive or authoritative. The information was collected for research purposes only.

Government Publication Date: 1915-1953*

Transport Canada Fuel Storage Tanks: Federal TCFT

List of fuel storage tanks currently or previously owned or operated by Transport Canada. This inventory also includes tanks on The Pickering Lands, which refers to 7,530 hectares (18,600 acres) of land in Pickering, Markham, and Uxbridge owned by the Government of Canada since 1972; properties on this land has been leased by the government since 1975, and falls under the Site Management Policy of Transport Canada, but is administered by Public Works and Government Services Canada. This inventory provides information on the site name, location, tank age, capacity and fuel type.

Government Publication Date: 1970-Jan 2015

TSSA Variances for Abandonment of Underground Storage Tanks: Provincial VAR

List of variances granted for abandoned tanks. Under the Technical Standards and Safety Authority (TSSA) Liquid Fuels Handling Code and Fuel Oil Code, all underground storage tanks must be removed within two years of disuse. If removal of a tank is not feasible, an application may be sought for a variance from this code requirement.

Government Publication Date: Feb 28, 2017

Waste Disposal Sites - MOE CA Inventory: Provincial WDS

The Ontario Ministry of Environment, Waste Management Branch, maintains an inventory of known open (active or inactive) and closed disposal sites in the Province of Ontario. Active sites maintain a Certificate of Approval, are approved to receive and are receiving waste. Inactive sites maintain Certificate(s) of Approval but are not receiving waste. Closed sites are not receiving waste. The data contained within this database was compiled from the MOE's Certificate of Approval database. Locations of these sites may be cross-referenced to the Anderson database described under ERIS's Private Source Database section, by the CA number. All new Environmental Compliance Approvals handed out after Oct 31, 2011 for Waste Disposal Sites will still be found in this database.

Government Publication Date: Oct 31, 2017

Waste Disposal Sites - MOE 1991 Historical Approval Inventory: Provincial WDSH

In June 1991, the Ontario Ministry of Environment, Waste Management Branch, published the "June 1991 Waste Disposal Site Inventory", of all known active and closed waste disposal sites as of October 30st, 1990. For each "active" site as of October 31st 1990, information is provided on site location, site/CA number, waste type, site status and site classification. For each "closed" site as of October 31st 1990, information is provided on site location, site/CA number, closure date and site classification. Locations of these sites may be cross-referenced to the Anderson database described under ERIS's Private Source Database section, by the CA number.

Government Publication Date: Up to Oct 1990*

Water Well Information System: Provincial WWIS

This database describes locations and characteristics of water wells found within Ontario in accordance with Regulation 903. It includes such information as coordinates, construction date, well depth, primary and secondary use, pump rate, static water level, well status, etc. Also included are detailed stratigraphy information, approximate depth to bedrock and the approximate depth to the water table.

Government Publication Date: Mar 31, 2017

Definitions

Database Descriptions: This section provides a detailed explanation for each database including: source, information available, time coverage, and acronyms used. They are listed in alphabetic order.

Detail Report: This is the section of the report which provides the most detail for each individual record. Records are summarized by location, starting with the project property followed by records in closest proximity.

Distance: The distance value is the distance between plotted points, not necessarily the distance between the sites' boundaries. All values are an approximation.

Direction: The direction value is the compass direction of the site in respect to the project property and/or center point of the report.

Elevation: The elevation value is taken from the location at which the records for the site address have been plotted. All values are an approximation. Source: Google Elevation API.

Executive Summary: This portion of the report is divided into 3 sections:

'Report Summary'- Displays a chart indicating how many records fall on the project property and, within the report search radii.

'Site Report Summary'-Project Property'- This section lists all the records which fall on the project property. For more details, see the 'Detail Report' section.

'Site Report Summary-Surrounding Properties'- This section summarizes all records on adjacent properties, listing them in order of proximity from the project property. For more details, see the 'Detail Report' section.

Map Key: The map key number is assigned according to closest proximity from the project property. Map Key numbers always start at #1. The project property will always have a map key of '1' if records are available. If there is a number in brackets beside the main number, this will indicate the number of records on that specific property. If there is no number in brackets, there is only one record for that property.

The symbol and colour used indicates 'elevation': the red inverted triangle will dictate 'ERIS Sites with Lower Elevation', the yellow triangle will dictate 'ERIS Sites with Higher Elevation' and the orange square will dictate 'ERIS Sites with Same Elevation.'

Unplottables: These are records that could not be mapped due to various reasons, including limited geographic information. These records may or may not be in your study area, and are included as reference.

ENVIRONMENTAL RISK INFORMATION SERVICE

Head Office: 80 Valleybrook Dr, Toronto, ON M3B 2S9
Physical Address: 38 Lesmill Rd, Toronto, ON M3B 2T5
Phone: 416-510-5204 • Fax: 416-510-5133
info@erisinfo.com • www.erisinfo.com

City Directory Information Source
Vernon's St Catharines, ON City Directory

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario
Year: 2012	
Site Listing:	-Address Not Listed

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario
Year: 2007	
Site Listing:	-Address Not Listed

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario
Year: 2002	

Site Listing:	-Address Not Listed

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario
Year: 1997	
Site Listing:	-Address Not Listed

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario
Year: 1992	
Site Listing:	-Address Not Listed

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario
Year: 1987	
Site Listing:	-Address Not Listed

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario

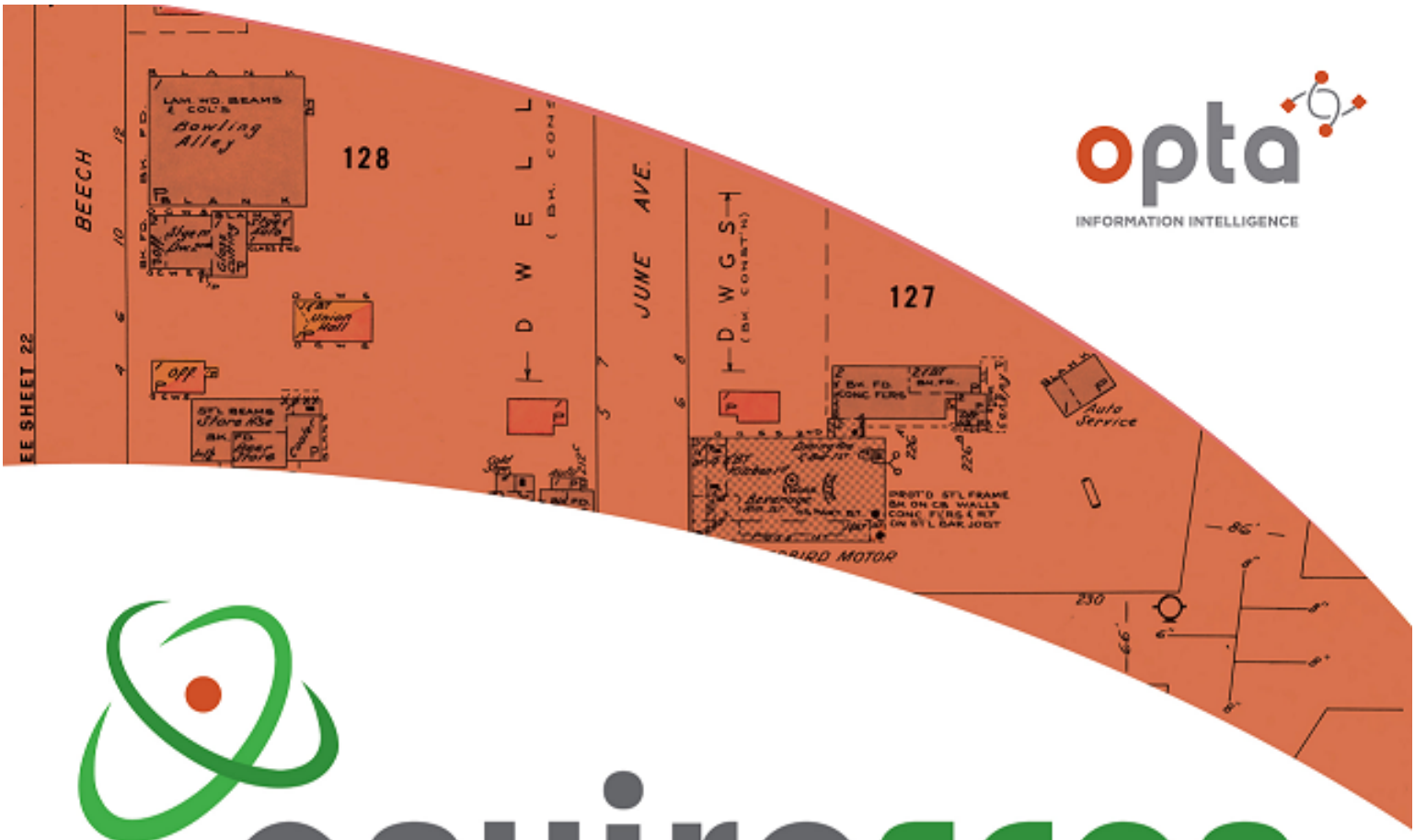
Year: 1982	
Site Listing:	-Address Not Listed

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario
Year: 1977	
Site Listing:	-Address Not Listed

PROJECT NUMBER: 20171219151	
Site Address:	4 Welland Canals Parkway, St. Catharines, Ontario
Year: 1972	
Site Listing:	-Address Not Listed

-All listings for businesses were listed as they are in the city directory.

-Listings that are residential are listed as “residential” with the number of tenants. The name of the residential tenant is not listed in the above city directory



opta
INFORMATION INTELLIGENCE

enviroscan

An SCM Company

175 Commerce Valley Drive W
Markham, Ontario L3T 7Z3

T: 905-882-6300
W: www.optaintel.ca

Report Completed By:

Catherine

Site Address:

Welland ON

Project No:

20171205261

Opta Order ID:

43673

Requested by:

Eleanor Goolab
Eris

Date Completed:

12/12/2017 7:52:34 AM

Project Name: Port Weller

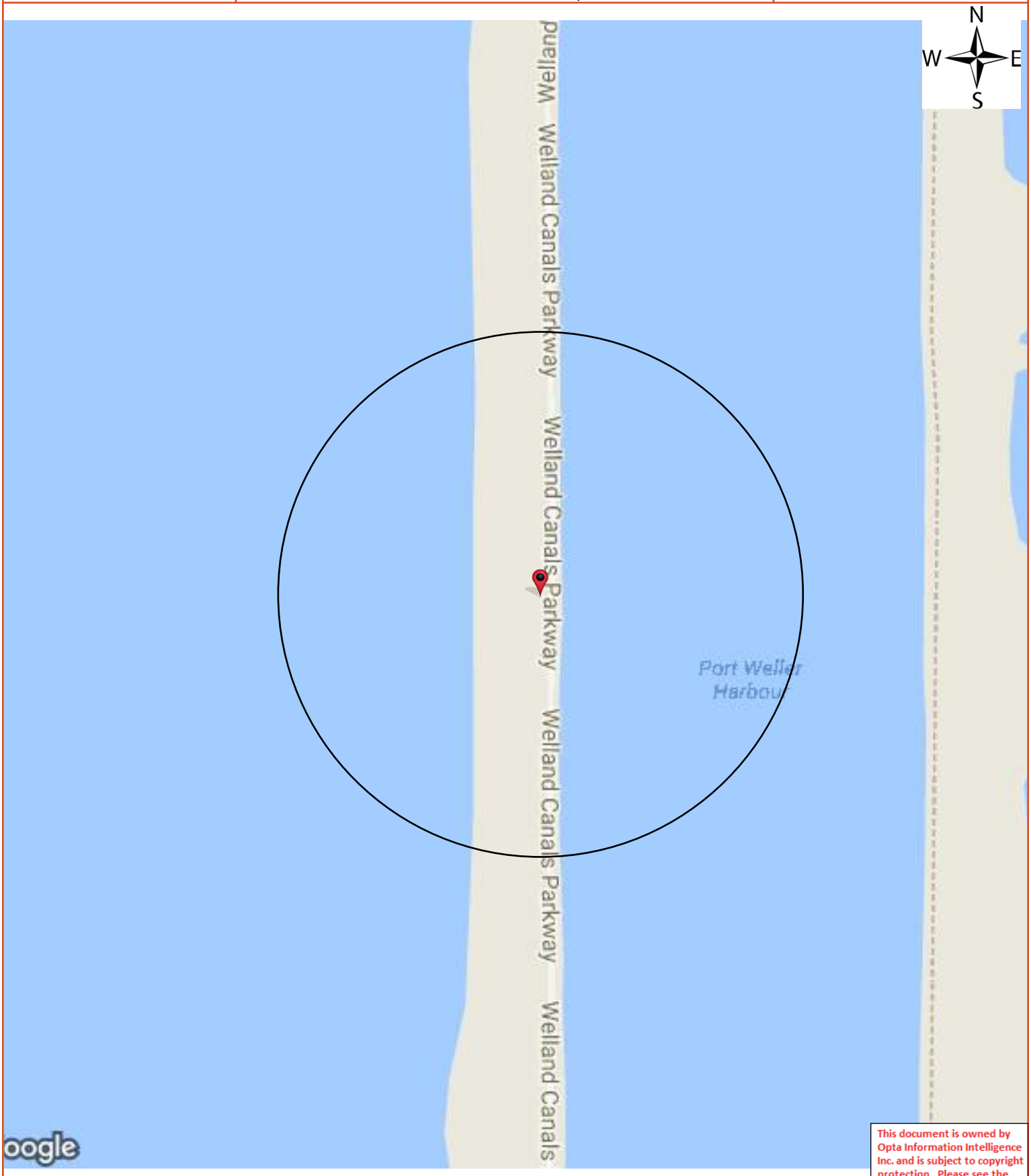
Project #: 20171205261
P.O. #: 81885

ENVIROSCAN Report

Search Area: Welland ON

Requested by:
Eleanor Goolab
Date Completed: 12/12/2017 07:52:34

enviroscan
OPTA INFORMATION INTELLIGENCE



Opta Historical Environmental Services Enviroscan™ Terms and Conditions

Report

The documents (hereinafter referred to as the "Documents") to be released as part of the report (hereinafter referred to as the "Report") to be delivered to the purchaser as set out above are documents in Opta's records relating to the described property (hereinafter referred to as the "Property"). Opta makes no representations or warranties respecting the Documents whatsoever, including, without limitation, with respect to the completeness, accuracy or usefulness of the Documents, and does not represent or warrant that these are the only plans and reports prepared in association with the Property or in Opta's possession at the time of Report delivery to the purchaser. The Documents are current as of the date(s) indicated on them. Interpretation of the Documents, if any, is by inference based upon the information which is apparent and obvious on the face of the Documents only. Opta does not represent, warrant or guarantee that interpretations other than those referred to do not exist from other sources. The Report will be prepared for use by the purchaser of the services as shown above hereof only.

Disclaimer

Opta disclaims responsibility for any losses or damages of any kind whatsoever, whether consequential or other, however caused, incurred or suffered, arising directly or indirectly as a result of the services (which services include, but are not limited to, the preparation of the Report provided hereunder), including but not limited to, any losses or damages arising directly or indirectly from any breach of contract, fundamental or otherwise, from reliance on Opta Reports or from any tortious acts or omissions of Opta's agents, employees or representatives.

Entire Agreement

The parties hereto acknowledge and agree to be bound by the terms and conditions hereof. The request form constitutes the entire agreement between the parties pertaining to the subject matter hereof and supersedes all prior and contemporaneous agreements, negotiations and discussions, whether oral or written, and there are no representations or warranties, or other agreements between the parties in connection with the subject matter hereof except as specifically set forth herein. No supplement, modification, waiver, or termination of the request shall be binding, unless confirmed in writing by the parties hereto.

Governing Document

In the event of any conflicts or inconsistencies between the provisions hereof and the Reports, the rights and obligations of the parties shall be deemed to be governed by the request form, which shall be the paramount document.

Law

This agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein.

ENVIROSCAN Report

No Records Found

Requested by:
Eleanor Goolab
Date Completed: 12/12/2017 07:52:34

OPTA INFORMATION INTELLIGENCE

No Records Found

N
W E
S

Appendix 4 Correspondance

ENGLOBE PROJECT INFORMATION 9-11am			
Project Number: P000907L-225	Start Date: DEC 15/17	Date Due: DEC 15/17	
Location: 4 WELLAND CANALS PKWY, ST CATHARINES			
Client: AVCSC	Phone: -	Email: -	
Site Contact: SCOTT PARKER	Phone: 905-934-2446	Email: -	
Assessor: A. DUNSRACK			
Note: See Project Information Form for additional details.			

INTERVIEW QUESTIONNAIRE

Personnel Interviewed: SCOTT PARKER Date: DEC 15/17

Contact Info. and Phone No: SCOTT PARKER 905-934-2446

Duties and Experience of Staff Interviewed: CAPTAIN CANADIAN COAST GUARD ~34YRS

1. What was the nature of the business? Briefly Describe site operations:

   SEARCH AND RESCUE FACILITY - RESIDENCE/OPERATIONS.

2. Year building(s) constructed? 1930's / 1950's - INFILLED LAND 1900's
3. What chemicals were used or stored on site?

   FUELS - GAS / DIESEL / WASTE OILS

4. Have there been any chemical spills on the property? If so, what chemicals, where and how were they cleaned up?

   NOT AWARE OF ANY

5. Where were chemicals stored?

   ABOVEGROUND IN ASTs - SOME IN HAZARDOUS OBJECTS IN SHEDS

6. How was waste-water handled/stored/disposed?

   ON SITE SEPTIC SYSTEM

7. What sanitary sewage system was used on site?

   ON SITE SEPTIC SYSTEM

8. Were there any landfills/dumps on site? If so, where, and what was disposed?

   NOT AWARE OF ANY - SITE IS INFILLED LAND

9. How were solid wastes disposed of and where?

   LOCKED BIN - GENERAL REFUSE - SOUTHERN PORTION OF SITE.

10. Were there any underground or above ground storage tanks on the property? Have there been any reported leaks or spills? Have they been tested?

    NO KNOWN USTs

    6 ASTs - SEE AST SECTION

    BY NOT AWARE OF INSPECTIONS OR SPILLS.

11. Were there any fluid-filled transformers or other electrical equipment on the property? Where? Have they been tested for PCB content?

TRANSFORMER ON POLE WEST OF MAIN BUILDING. UNKNOWN IF PCB'S OWNED BY CITY.

12. What type of insulation was used in the building?

NOT AWARE

13. Were there any ground water wells on the property? Has the water been tested?

POTABLE WELL ON SITE, NOT AWARE OF TESTING

14. What happened to surface run-off?

INFILTRATES OR IS DIRECTED TO THE LAKE/CANAL

15. Did the facility use radioactive materials?

NO

16. Was hazardous waste generated on site? Did you have a waste generator number?

YES, WASTE OILS/FUELS - SEE INVENTORY.

17. Were there any known environmental problems relating to the site, such as any civil, criminal, or administrative proceedings or fines which have been assessed?

NOT AWARE OF ANY

18. Have there been any occupational health and safety inspections by regulatory agencies? Findings?

NOT AWARE

19. Have there been any fires on the property?

NOT AWARE

20. Have there ever been any previous geotechnical or environmental investigations for the property? Any asbestos surveys?

YES, CHECK WITH PUBLIC.

21. Are there any building/site drawings available for review?

CONTACT PUBLIC

22. Are there any other company records available for review? (i.e. – permits, maintenance records, asbestos surveys, spill records, chemical storage inventory)

CONTACT PUBLIC

23. Are there any previous Phase I ESA reports available for review?

YES, SINCE CANNON.

24. Any other contacts, if necessary. (i.e. owner, custodian, manager, previous owners, tenants, etc.)? Please list:

NOT AWARE

A) SITE VISIT

Location of Site:

4 KILOMETRES SOUTH OF CATHEDRAL

Legal Description:

NOT AVAILABLE

Current Owner:

ST. LAWRENCE SEAWAY MANAGEMENT CORPORATION

Current Manager:

SCOTT PARKER – CANADIAN COAST GUARD.

Nearest Intersection:

LAKESHORE ROAD.

Site Designation:

RES / COMMERCIAL / INDUSTRIAL

Rights-of-Way/Easements:

NOT AVAILABLE.

Municipal Water Supply:

NO

BUILDING INVENTORY

Number of Buildings: EIGHT — MAIN BUILDING / ADMINISTRATIVE OFFICE / STORAGE SHEDS x 4 / EC STATION

Type of Construction:

Date of Construction:

Built By: ? — 1930/1950 AND ONWARDS.

Building Uses: RES / STORAGE

Building Size (m^2): UNKNOWN

Number of Floors: 1

Basement(s) yes ☑ no ☐ MAIN BUILDING

Additions/Renovations: YES THROUGHOUT.

Demolitions:

NOT KNOWN

Lighting:

Insulation: ?

Floor Coverings: TILE / WOOD / VINYL

Access to Buildings? yes ☑ no ☐

Limitations to Access:

STORAGE SHED / EC STATION LOCKED

Was there any staining on the floors, walls, ceilings, sumps, or drains? yes ☐ no ☑

NOT SIGNIFICANT

Describe:

HEATING/COOLING

Is the structure provided with heat? yes ☑ no ☐

If yes, check the type:

natural gas	☐	*electric*	☑
propane	☐	*coal*	☐
wood	☐	*steam*	☐
oil	☑	*unknown*	☐

Age of System: NEW BUT ALWAYS HEATED BY OIL

Previous System Used:

Is there a cooling system? yes ☑ no ☐ AC UNITS

Hot Water supply: YES ELECTRIC

PUBLIC OR PRIVATE SERVICES	
Circle all that apply:	
natural gas	*rail lines*
cable	*sanitary sewer*
roadways ✓	*parking lots*
electricity ✓	*telephone* ✓
storm sewer	*pipelines*
other:	*municipal water*

SEPTIC SYSTEM

Is there a septic system? *yes* ☑ *no* ☐
Have there been any problems with the septic system? *yes* ☐ *no* ☑
Any visual indications of system failure? *yes* ☐ *no* ☑

Stormwater drainage: TO LAKE / CANAL

Are there visible signs of contamination on or near any water? *yes* ☐ *no* ☑

B) SURFACE CONDITIONS

SOILS/GEOLOGY

- ☑ *fill*
- ☐ *sand*
- ☐ *gravel*
- ☐ *clay*
- ☐ *silt*
- ☑ *unknown*
- ☐ *rocky outcrops*
- ☐ *other:*

Is there any sign of contamination on the ground? *yes* ☐ *no* ☑
If yes, note area of impact and location:

Accessibility of Drilling Equipment:

SURFACE WATER/DRAINAGE

wetlands	☐	***ditches***	☐
rivers/streams	☐	***creeks***	☐
ponds	☐	***other***	LAKE (WEST/EAST)

VEGETATION
Is there vegetation on the site? yes ☑ no ☐ *If yes, check those that apply:* ☐ *crops* *type:* ☑ *trees* ☑ *landscaping* ☑ *grass* ☑ *shrubs* *Is there any sign of stressed vegetation?* yes ☐ no ☑ *Are there any wetlands on or in the vicinity of the property?* yes ☐ no ☑

C) WASTE EVIDENCE

Discoloured Soil: NOT OBSERVED

Odours: NOT NO

Vegetation Damage: NOT OBSERVED

Discolouration of Ponded Water: N/A NOT OBSERVED

Waste Material: IN COLLECTION BIN

Drums, Barrels, Containers: IN SHEDS

Construction Materials: NOT OBSERVED

Transformers: NO

Petroleum Storage: ASTs

Chemical Storage: HAZARDOUS CABINET

Waste Piles: NOT OBSERVED

Other:

D) SITE AND ADJACENT PROPERTY

Current Property Uses: (List all current businesses, land usage, and activities.)

COAST GUARD.

Historical Land Usage: (List all previous known usages as well as source of information.)

PREVIOUSLY LAKE - INFILLED 1900's

Adjacent Land Usage: (Current) List businesses, land use, and activities:

North: VACANT LAND

East: WETLAND CANAL

South: VACANT LAND.

West: LAKE ONTARIO

Items of Potential Concern: (USTs, ASTs, potential hazardous usages, gas stations, etc. and proximity to site, use sketch if necessary.)

ASTs ON SITE.

Historical Adjacent Land Use: (List all known historical usage and source of information.)

North:

East:

South:

West:

LAKE ONTARIO

Items of Potential Concern:

E) INSIDE BUILDING

POLYCHLORINATED BIPHENYLS (PCBs)
Are PCBs present on the property? NOT AWARE *If yes, check those that apply:* POLE MOUNTED TRANSFORMERS
Transformers ☑ *pole top* ☐ *ground* ☐ *wall-mounted* *Owner:*
Have there been any leaks? *Has a cleanup ever been performed?* NOT AWARE *Are sampling results available?*
Fluorescent light fixtures (pre-1980) *number:* *Have any been removed?* NOT AWARE OF PCB, BUT *How were they disposed of?* FLUORESCENT LIGHTS PRESENT
Hydraulic equipment *type:* *age:* NA
Other old electrical equipment *describe:* *Is the property part of a registered PCB Storage Site?* N/A *Site # / Generator #:* *Amount and type of material stored:*
ASBESTOS-CONTAINING MATERIALS (ACM)
Date of building construction: 1930/1950 *Is there asbestos on the property?* *If yes, check those that apply:* ☐ *spray-on fireproofing* ☐ *furnace/boiler insulation* ☐ *pipe insulation* POTENTIAL - SEE PREVIOUS REPORTS. ☐ *acoustical ceiling tiles* ☑ *roof shingle* ☐ *vinyl floor tiles* ☐ *sheeting* ☐ *other* BY WINDOW / CAULKING *Has an asbestos survey ever been conducted for the property?* YES *Has any ACM been removed from the property?* NOT AWARE.

LEAD

Has lead paint been used on the interior or exterior building surfaces? yes ☐ no ☐
If yes, describe condition and location: NOT KNOWN

List other potential sources of Lead

UREA FORMALDEHYDE FOAM INSULATION (UFFI)

Is there any UFFI in any of the buildings? yes ☐ no ☐ NOT KNOWN

Is there any visible signs of UFFI (vent holes, injection points, wall cavities):
NONE OBSERVED

OTHER DESIGNATED SUBSTANCES (ODSs)

Are there any sources of ODSs present at the site? yes ☐ no ☐ NOT KNOWN

UNDERGROUND STORAGE TANKS (USTs)

Are USTs on or near the property? yes ☐ no ☑ NOT KNOWN
If yes, how many?
In use, abandoned, removed?
Is a Fire Insurance Plan available? NO

	type	age	size	contents	condition	location
1						
2						
3						

How long has/have the tanks(s) been out of service?
Were the tank(s) emptied prior to being removed from service?
Sampling? Report(s)?

Are any of the following potential UST indicators present: NONE OBSERVED.

- ☐ *vent pipe*
- ☐ *depression*
- ☐ *staining*
- ☐ *mound*
- ☐ *fill pipe*

ABOVEGROUND STORAGE TANKS (ASTs)

If yes, how many?
In use, abandoned, removed?

	type	age	size	contents	condition	location
1	STEEL	2011	1100	FUEL OIL	GOOD	SW CORNER
2	STEEL	2011	1100	FUEL OIL		NW CORNER
3		-	GEN	DIESEL		W SIDE

11,000 DIESEL N MAIN BLDG
1,900L GASOLINE W SIDE
500L WASTE OIL IN SHED

Are any of the ASTs equipped with spill containment?

11,000 L DIESEL – YES

History of spills, overfills, and/or leaks?

NOT KNOWN

Have any soil/groundwater investigations been completed? SOIL YES – NO GW STUDY

OTHER STORAGE AREAS

Hazardous Materials – check all that apply:

solvents	☐	***batteries***	☐
paint thinners	☐	***herbicides***	☐
glues	☐	***paints***	☑
pesticides	☐	***oils***	☐
fuels	☑	***compressed gases***	☐
antifreeze	☐	***radioactive materials***	☐
		other:	

Of these materials, how are they stored? JERRY CANS IN HAZARDOUS CONTAINERS.

☑ containers <20 L (#)	**number:** N/O	☐ drums (#)	**number:**
☐ containers >20 L (#)	**number:**	☐ tanks (#)	**number:**

Hazardous Materials – check all that apply:

tires	☐	*glass*	☐
paper	☐	*wood*	☐
plastic	☐	*cardboard*	☐
metal	☐	*other*	☐

Storage:

in sealed containers	☑	*properly labeled*	☐
evidence of leaking/rusty containers	☐	*close to drains, sumps, or waterways*	☐
in secure storage areas	☑	*no labels*	☐
containers outside in the open	☐ NA	*other*	

Spillage or staining in storage areas? NOT OBSERVED.

Secondary Containment present?

SOLID WASTE

Check all that apply:

- ☐ *metal*
- ☐ *wood*
- ☑ *plastic*
- ☑ *paper*
- ☐ *batteries*
- ☐ *tires*
- ☑ *cardboard*
- ☑ *glass*
- ☐ *other:*

GENERAL REFUSE

Average quantity of wastes generated weekly:
Are any solid wastes recycled?

Solid waste disposal:

Any evidence of uncontrolled dumping on or near property? ☐ *yes* ☐ *no*

CHEMICAL AND HAZARDOUS WASTES

Are fuel or chemical wastes generated at the site? WASTE OILS - CHECK WITH
MOE generator No.:

Check all that apply:

- ☐ *solvents*
- ☐ *paints*
- ☐ *thinners*
- ☑ *fuels*
- ☑ *oils/lubricants*
- ☐ *radioactive wastes*
- ☐ *antifreeze*
- ☐ *CFCs*
- ☐ *pesticides/herbicides*
- ☐ *other:*

Storage: AIT.

Disposal methods (past and present):

Waste generation and disposal:

Waste Stream / Generator No.	Hazardous / Non-Hazardous	Transporter	Disposal / Recycling Facility

GENERATOR / FURNACE

AIR EMISSIONS

Are there any air emissions from the property? ☑ *yes* ☐ *no*
If yes, check all that apply:

odors	☐	*vent stacks*	☐	*wall vents*	☐
visible particulates	☐	*buildup of dusts*	☐	*soot*	☐

If stacks or vents – location, number, size, use

Has any monitoring of air emissions been performed? NOT AWARE

Is there any treatment of air emissions prior to discharge?

Does the facility have a Certificate of Approval (Air)?
If yes, list C of A #'s:

LIQUID DISCHARGES

Are any liquid wastes other than domestic sewage generated at the site? ONLY DOMESTIC
If no, skip to next section.

If yes, where is the waste treated?:

☐ *on site*
☐ *off site*
☐ *both*

Check any that apply:

☐ *collection pond*
☐ *sumps*
☐ *sludge lagoon*
☐ *oil interceptor*
☐ *drains*
☐ *receptors for all floor drains*

FILL

Are there any fill areas on the site? SITE HAS BEEN INFILLED.

NOISE/VIBRATION

Are there any sources of excessive noise or vibration at the site? FURNACE DRYER

ELECTROMAGNETIC FIELDS (EMF)

Are there any sources of EMF present at or near the site? NOT AWARE.

Ministry of the Environment and Climate Change

Freedom of Information and Protection of Privacy Office

12th Floor
40 St. Clair Avenue West
Toronto ON M4V 1M2
Tel: (416) 314-4075
Fax: (416) 314-4285

Ministère de l'Environnement et de l'Action en matière de changement climatique

Bureau de l'accès à l'information et de la protection de la vie privée

12e étage
40, avenue St. Clair ouest
Toronto ON M4V 1M2
Tél. : (416) 314-4075
Téléc.: (416) 314-4285

Ontario

161-P0009072-0-01-225

January 2, 2018

Project No :

Received on : JAN 0 4 2018	VERIFICATION	INITIALS	FILING
Recipient: A. DUNBRACK	V	AD	
Distribution :			

Andrew Dunbrack
Englobe Corp
353 Bridge St E
Kitchener, ON N2K 2Y5

Dear Andrew Dunbrack:

RE: ***Freedom of Information and Protection of Privacy Act* Request**
Our File # A-2017-08898, Your Reference P9072-225

This letter is in response to your request made pursuant to the *Freedom of Information and Protection of Privacy Act* relating to 4 Welland Canals Parkway, St. Catharines.

After a thorough search through the files of the Ministry's Niagara District Office, West-Central Region, Investigations and Enforcement Branch, Environmental Monitoring and Reporting Branch, Sector Compliance Branch and Safe Drinking Water Branch, no records were located responsive to your request. To provide you with this response and in accordance with Section 57 of the *Freedom of Information and Protection of Privacy Act*, the fee owed is $30.00 for 1 hour of search time @ $30.00 per hour. **We have applied the $30.00 for this request from your initial payment.**

To conduct a search through the files of the Environmental Assessment and Permissions Branch requires an additional 8 hours. If you would like us to search for Environmental Compliance Approvals/Certificates of Approval at the Environmental Assessment and Permissions Branch (EAPB), please forward to me at the above address payment by money order or cheque (made payable to the "Minister of Finance (FOI)") or by credit card in the amount of $240.00. Please note that there is no guarantee any records will be located responsive to your request. Credit card forms are available on the Ministry's website http://www.ontario.ca/environment-and-energy/freedom-information-request-form. Please note, a request for records must usually be answered within 30 calendar days, however Section 27 allows for time extensions under certain circumstances. If you choose to have the search conducted at the Environmental Assessment and Permissions Branch, the time for answering your request will be extended for an additional 30 days.

When remitting payment please quote our file number or attach a copy of this letter.

You may request a review of my decision by contacting the Information and Privacy Commissioner/Ontario, 2 Bloor Street East, Suite 1400, Toronto, ON M4W 1A8 (800-387-0073 or 416-326-3333). Please note that there is a $25.00 fee and you only have 30 days from receipt of this letter to request a review.

If you have any questions regarding this matter, please contact Michael Kolaric at 416-327-3036.

Yours truly,

FOR

Janet Dadufalza
FOI Manager

Andrew Dunbrack

From: FPP.CA / PPP.CA (DFO/MPO) <fisheriesprotection@dfo-mpo.gc.ca>
Sent: Friday, January 05, 2018 3:50 PM
To: Sarah Taylor
Cc: Wadden, Christine R
Subject: RE: SAR Information Request - 4 Welland Canals Parkway, St. Catharines

Hi Sara,

Thank you for contacting the Fisheries Protection Program (FPP). FPP is tasked with enforcing the *Fisheries Act*, which pertains only to aquatic species at risk (SAR), i.e. fish, mussels, and marine mammals. As such, we cannot offer insight into other federally-listed SAR.

According to our maps, the only aquatic SAR in the vicinity of the project site that was not mentioned is America eel, which is currently listed as Special Concern.

Hopefully this helps.

Michael Bedford

Fisheries Protection Biologist | Biologiste, protection des pêches
Fisheries Protection Program | Programme de Protection des Pêches
Central and Arctic Region | Région du Centre et de l'Arctique
Fisheries and Oceans Canada | 867 Lakeshore Road, Burlington ON L7S 1A1
Pêches et Océans Canada | 867, ch. Lakeshore, Burlington ON L7S 1A1
Government of Canada | Gouvernement du Canada

From: Sarah Taylor [mailto:Sarah.Taylor@englobecorp.com]
Sent: January-05-18 12:54 PM
To: Info / Info (DFO/MPO)
Cc: Andrew Dunbrack
Subject: SAR Information Request - 4 Welland Canals Parkway, St. Catharines

Hello,

Our company has been retained by PWGSC to carry out a Species at Risk assessment for a Site located at the Port Weller Canadian Coast Guard Search and Rescue Station, 4 Welland Canals Parkway in St. Catharines, Ontario.

I have done some work using the "Species at risk by area" tool: https://www.ontario.ca/environment-and-energy/species-risk-region?name=Niagara
In it I discovered that the following species are at risk within the Niagara region:

Amphibians
Allegheny Mountain Dusky Salamander, Fowler's Toad, Jefferson Salamander, Northern Dusky Salamander

Birds
Acadian Flycatcher, Bald Eagle, Barn Owl, Barn Swallow, Black Tern, Bobolink, Cerulean Warbler, Eastern Meadowlark, Least Bittern, Louisiana Waterthrush, Peregrine Falcon, Piping Plover, Prothonotary Warbler, Yellow-breasted Chat

Fish and Mussels
Eastern Pondmussel, Kidneyshell, Lake Chubsucker, Redside Dace, Round Pigtoe, Snuffbox

Insects
Rusty-patched Bumble Bee

Mammals
Woodland Vole

Plants and Lichens
American Chestnut, American Columbo, American Water-willow, Broad Beech Fern, Cherry Birch, Common Hoptree, Cucumber Tree, Deerberry, Dwarf Hackberry, Eastern Flowering Dogwood, Green Dragon, Red Mulberry, Round-leaved Greenbrier, Shumard Oak, Spoon-leaved Moss, Spotted Wintergreen, Swamp Rose-mallow, Virginia Mallow, White Wood Aster

Snakes and Lizards
Common Five-lined Skink, Eastern Ribbonsnake, Gray Ratsnake, Massasauga

Turtles
Blanding's Turtle, Eastern Musk Turtle, Northern Map Turtle, Snapping Turtle, Spiny Softshell

I also used the Make a Map: Natural Heritage Areas tool:
http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US
This listed Cherry Birch, Black Snakeroot, Northern Hawthorn, Bird's-foot Violet, Cucumber Tree, Broad Beech Fern, Swamp rose-mallow, Sundial Lupine, and American Eel.

I also consulted the Conservation Ontario 2015 Aquatic Species at Risk maps: http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm
Here I discovered that the Deepwater Sculpin, Eastern Pondmussel, Grass Pickerel, Kidneyshell, Lake Chubsucker, Mapleleaf, Northern Brook Lamprey, Round Hickorynut, and Round Pigtoe are of concern.

I was wondering if there are any other species at risk I should consider as part of this assessment?

Thank you in advance for your assistance,
Sarah

SARAH TAYLOR, EIT
Environmental Group

Englobe
353 Bridge Street East
Kitchener (Ontario) N2K 2Y5
T 519.741.1313 ext 247 / cell. 519.616.0814
F 519.741.5422
sarah.taylor@englobecorp.com
www.englobecorp.com

Andrew Dunbrack

From: Lee-Ann Hamilton <lhamilton@npca.ca>
Sent: Friday, January 05, 2018 2:54 PM
To: Sarah Taylor
Cc: Kim Frohlich; Andrew Dunbrack
Subject: RE: SAR Information Request - 4 Welland Canals Parkway, St. Catharines

Hi Sarah,

I have been asked to respond to your request for information regarding Species at Risk in the Niagara area. While the NPCA does not regulate Species at Risk, nor keep the most up-to-date records for the Niagara area, I can assist you with a bit of additional information. I would encourage you to inquire at esaguelph@ontario.ca to contact our local Ministry of Natural Resources and Forestry staff who would have the best available information in this regard.

Additional Species at Risk known to occur in Niagara would also include:

Birds
Bank Swallow (THR)
Chimney Swift (THR)
Common Nighthawk (SC)
Eastern Whip-poor-will (THR)
Eastern Wood-pewee (SC)
Golden-winged Warbler (SC)
Henslow's Sparrow (END)
King Rail (END)
Northern Bobwhite (END)
Red-headed Woodpecker (SC)
Wood Thrush (SC)

Fish
Lake Sturgeon (THR)

Insects
Monarch Butterfly (SC)
West Virginia White (SC)

Mammals
Eastern Small-footed Myotis (END)
Little Brown Myotis (END)
Northern Myotis (END)
Tri-colored Bat (END)

Plants
American Ginseng (END)
Butternut (END)
Common Hoptree (SC)
Drooping Trillium (END)

Snakes and Lizards

Eastern Hog-nosed Snake (THR)

Turtles
Spotted Turtle (END)

There are likely more that could be added to this list, but again the MNRF staff would be the best source of that information. Many of these and those you have listed may not be considered a potential concern for your site based on location and suitable habitat, but it would be best to discuss this with MNRF staff.

Thanks and please let me know if there's any way I can be of further assistance,

Lee-Ann Hamilton
Supervisor, Watershed Biology
Niagara Peninsula Conservation Authority
250 Thorold Road West, 3rd Floor
Welland, ON L3C 3W2
905.788.3135 x. 265
lhamilton@npca.ca

From: Sarah Taylor [mailto:Sarah.Taylor@englobecorp.com]
Sent: Friday, January 05, 2018 1:04 PM
To: Info <info@npca.ca>
Cc: Andrew Dunbrack <Andrew.Dunbrack@englobecorp.com>
Subject: SAR Information Request - 4 Welland Canals Parkway, St. Catharines

Hello,

Our company has been retained by PWGSC to carry out a Species at Risk assessment for a Site located at the Port Weller Canadian Coast Guard Search and Rescue Station, 4 Welland Canals Parkway in St. Catharines, Ontario. I believe this Site is included within the region covered by the Niagara Peninsula Conservation Authority.

I have done some work using the "Species at risk by area" tool: https://www.ontario.ca/environment-and-energy/species-risk-region?name=Niagara
In it I discovered that the following species are at risk within the Niagara region:

Amphibians
Allegheny Mountain Dusky Salamander, Fowler's Toad, Jefferson Salamander, Northern Dusky Salamander

Birds
Acadian Flycatcher, Bald Eagle, Barn Owl, Barn Swallow, Black Tern, Bobolink, Cerulean Warbler, Eastern Meadowlark, Least Bittern, Louisiana Waterthrush, Peregrine Falcon, Piping Plover, Prothonotary Warbler, Yellow-breasted Chat

Fish and Mussels
Eastern Pondmussel, Kidneyshell, Lake Chubsucker, Redside Dace, Round Pigtoe, Snuffbox

Insects
Rusty-patched Bumble Bee

Mammals
Woodland Vole

Plants and Lichens

American Chestnut, American Columbo, American Water-willow, Broad Beech Fern, Cherry Birch, Common Hoptree, Cucumber Tree, Deerberry, Dwarf Hackberry, Eastern Flowering Dogwood, Green Dragon, Red Mulberry, Round-leaved Greenbrier, Shumard Oak, Spoon-leaved Moss, Spotted Wintergreen, Swamp Rose-mallow, Virginia Mallow, White Wood Aster

Snakes and Lizards
Common Five-lined Skink, Eastern Ribbonsnake, Gray Ratsnake, Massasauga

Turtles
Blanding's Turtle, Eastern Musk Turtle, Northern Map Turtle, Snapping Turtle, Spiny Softshell

I also used the Make a Map: Natural Heritage Areas tool:
http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US
This listed Cherry Birch, Black Snakeroot, Northern Hawthorn, Bird's-foot Violet, Cucumber Tree, Broad Beech Fern, Swamp rose-mallow, Sundial Lupine, and American Eel.

I also consulted the Conservation Ontario 2015 Aquatic Species at Risk maps: http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm
Here I discovered that the Deepwater Sculpin, Eastern Pondmussel, Grass Pickerel, Kidneyshell, Lake Chubsucker, Mapleleaf, Northern Brook Lamprey, Round Hickorynut, and Round Pigtoe are of concern.

I was wondering if there are any other species at risk I should consider as part of this assessment?

Thank you in advance for your assistance,
Sarah

SARAH TAYLOR, EIT
Environmental Group

Englobe
353 Bridge Street East
Kitchener (Ontario) N2K 2Y5
T 519.741.1313 ext 247 / cell. 519.616.0814
F 519.741.5422
sarah.taylor@englobecorp.com
www.englobecorp.com

Andrew Dunbrack

From: Faune.Ontario / Wildlife.Ontario (EC) <ec.faune.ontario-wildlife.ontario.ec@canada.ca>
Sent: Monday, January 08, 2018 12:06 PM
To: Sarah Taylor
Subject: RE: SAR Information Request - 4 Welland Canals Parkway, St. Catharines

Dear Ms. Taylor,

Thank you for your email request. The management of wildlife in Canada is shared between the federal and provincial/territorial governments. The federal government is responsible for migratory birds and aquatic species wherever they occur, as well as for terrestrial species found on federal lands. The provinces and territories are normally responsible for all other wildlife conservation and management issues. In some circumstances, the Government of Canada can also have responsibility for other species through the federal Species at Risk Act (SARA). SARA is designed to work in a complementary fashion with provincial/territorial legislation to protect wildlife species and their habitats. In terms of data, Environment and Climate Change Canada is concerned about population-level information and less often has information about specific sites. The district offices of the Ontario Ministry of Natural Resources and Forestry are usually a better contact for that kind of information. Below please find several links that may help you find the information resources you are looking for.

Base Layers

- Information on topics such as Provincial Parks, Conservation Reserves, watercourse names, Environmental Significant Areas, Areas of Natural and Scientific Interest, wetlands, woodlands, etc can be obtained through the Ontario Ministry of Natural Resources and Forestry. You can see what's available through Land Information Ontario (LIO) by using the metadata search tool https://www.ontario.ca/page/land-information-ontario. You can also view many of these layers using the 'Make a Map' tool http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US
- Land cover, roads, rail and water layers at a national scale are freely available via Open Government Portal http://open.canada.ca/data/en/dataset?q=geobase&organization=nrcan-rncan&sort=

Species at Risk and other wildlife Information

- Federal and provincial information on species at risk are available through the Ontario Natural Heritage Information Centre: https://www.ontario.ca/page/natural-heritage-information-centre
- Completed (proposed and final) federal management plants, recovery strategies and action plans can be found on the Species at Risk Public Registry https://www.registrelep-sararegistry.gc.ca/
- Recovery Strategies for the province of Ontario and more details on species at risk can be found at http://www.ontario.ca/environment-and-energy/species-risk
- Species at Risk information is also available through the provincial 'Make a Map' tool (http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US)
- Information on Breeding Birds in Ontario is available through the Ontario Breeding Bird Atlas: www.birdsontario.org .
- Bird Studies Canada has information about various monitoring programs and volunteer initiatives, including programs such as the Marsh Monitoring Program and eBird. http://www.bsc-eoc.org/
- Information on fish or fish habitat should be directed to Fisheries and Oceans Canada http://dfo-mpo.gc.ca/ or to the Ontario Ministry of Natural Resources and Forestry http://www.ontario.ca/ministry-natural-resources-forestry.

Other Data search tools

- The province of Ontario's Open data catalog can be found at http://www.ontario.ca/government/open-data-ontario#LPP
- The federal open data catalog can be accessed at http://open.canada.ca/en/open-data

Although you may have already utilized some of these tools, I hope the additional resources assist you in your search. If you have further questions, please contact our office.

Thank you,

Caitlin Andersen, H.B.Comm
Senior Permits Officer
Canadian Wildlife Service
867 Lakeshore Road
Burlington, Ontario L7S 1A1
Tel: 905-336-4464
Fax: 905-336-4587
ec.wildlife.ontario.ec@canada.ca

From: Sarah Taylor [mailto:Sarah.Taylor@englobecorp.com]
Sent: January 5, 2018 12:55 PM
To: Faune.Ontario / Wildlife.Ontario (EC)
Cc: Andrew Dunbrack
Subject: SAR Information Request - 4 Welland Canals Parkway, St. Catharines

Hello,

Our company has been retained by PWGSC to carry out a Species at Risk assessment for a Site located at the Port Weller Canadian Coast Guard Search and Rescue Station, 4 Welland Canals Parkway in St. Catharines, Ontario.

I have done some work using the "Species at risk by area" tool: https://www.ontario.ca/environment-and-energy/species-risk-region?name=Niagara
In it I discovered that the following species are at risk within the Niagara region:

Amphibians
Allegheny Mountain Dusky Salamander, Fowler's Toad, Jefferson Salamander, Northern Dusky Salamander

Birds
Acadian Flycatcher, Bald Eagle, Barn Owl, Barn Swallow, Black Tern, Bobolink, Cerulean Warbler, Eastern Meadowlark, Least Bittern, Louisiana Waterthrush, Peregrine Falcon, Piping Plover, Prothonotary Warbler, Yellow-breasted Chat

Fish and Mussels
Eastern Pondmussel, Kidneyshell, Lake Chubsucker, Redside Dace, Round Pigtoe, Snuffbox

Insects
Rusty-patched Bumble Bee

Mammals
Woodland Vole

Plants and Lichens
American Chestnut, American Columbo, American Water-willow, Broad Beech Fern, Cherry Birch, Common Hoptree, Cucumber Tree, Deerberry, Dwarf Hackberry, Eastern Flowering Dogwood, Green Dragon, Red Mulberry, Round-leaved

Greenbrier, Shumard Oak, Spoon-leaved Moss, Spotted Wintergreen, Swamp Rose-mallow, Virginia Mallow, White Wood Aster

Snakes and Lizards
Common Five-lined Skink, Eastern Ribbonsnake, Gray Ratsnake, Massasauga

Turtles
Blanding's Turtle, Eastern Musk Turtle, Northern Map Turtle, Snapping Turtle, Spiny Softshell

I also used the Make a Map: Natural Heritage Areas tool:
http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US
This listed Cherry Birch, Black Snakeroot, Northern Hawthorn, Bird's-foot Violet, Cucumber Tree, Broad Beech Fern, Swamp rose-mallow, Sundial Lupine, and American Eel.

I also consulted the Conservation Ontario 2015 Aquatic Species at Risk maps: http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm
Here I discovered that the Deepwater Sculpin, Eastern Pondmussel, Grass Pickerel, Kidneyshell, Lake Chubsucker, Mapleleaf, Northern Brook Lamprey, Round Hickorynut, and Round Pigtoe are of concern.

I was wondering if there are any other species at risk I should consider as part of this assessment?

Thank you in advance for your assistance,
Sarah

SARAH TAYLOR, EIT
Environmental Group

Englobe
353 Bridge Street East
Kitchener (Ontario) N2K 2Y5
T 519.741.1313 ext 247 / cell. 519.616.0814
F 519.741.5422
sarah.taylor@englobecorp.com
www.englobecorp.com

Andrew Dunbrack

From: Reimer, Elizabeth (MNRF) <Elizabeth.Reimer@ontario.ca>
Sent: Friday, February 09, 2018 3:18 PM
To: Sarah Taylor
Cc: Andrew Dunbrack
Subject: RE: SAR Information Request - 4 Welland Canals Parkway, St. Catharines
Attachments: Fisheries_Data_PtWeller.pdf; St Catharines general SAR list.pdf; Welland Canal Seaway wetland evaluation.pdf; MNRF_response_Port_Weller_Pier.pdf

Hello Sarah and Andrew,
Please see the attached files for MNRF's response to your request for information on the property at 4 Welland Canals Parkway, St Catharines.

If you have further questions or concerns feel free to contact me directly by phone or email.

Regards,

Elizabeth Reimer

A/Management Biologist

Ministry of Natural Resources and Forestry
Guelph District - Vineland Field Office
P.O. Box 5000, 4890 Victoria Ave. N.
Vineland, ON L0R 2E0
Tel: (905) 562-0041

From: Sarah Taylor [mailto:Sarah.Taylor@englobecorp.com]
Sent: January 19, 2018 3:45 PM
To: ESA Guelph (MNRF)
Cc: Andrew Dunbrack
Subject: SAR Information Request - 4 Welland Canals Parkway, St. Catharines

Hello,

Our company has been retained by PWGSC to carry out a Species at Risk assessment for a Site located at the Port Weller Canadian Coast Guard Search and Rescue Station, 4 Welland Canals Parkway in St. Catharines, Ontario.

I have done some work using the "Species at risk by area" tool: https://www.ontario.ca/environment-and-energy/species-risk-region?name=Niagara
In it I discovered that the following species are at risk within the Niagara region:

Amphibians
Allegheny Mountain Dusky Salamander, Fowler's Toad, Jefferson Salamander, Northern Dusky Salamander

Birds
Acadian Flycatcher, Bald Eagle, Barn Owl, Barn Swallow, Black Tern, Bobolink, Cerulean Warbler, Eastern Meadowlark, Least Bittern, Louisiana Waterthrush, Peregrine Falcon, Piping Plover, Prothonotary Warbler, Yellow-breasted Chat

Fish and Mussels
Eastern Pondmussel, Kidneyshell, Lake Chubsucker, Redside Dace, Round Pigtoe, Snuffbox

Insects
Rusty-patched Bumble Bee

Mammals
Woodland Vole

Plants and Lichens
American Chestnut, American Columbo, American Water-willow, Broad Beech Fern, Cherry Birch, Common Hoptree, Cucumber Tree, Deerberry, Dwarf Hackberry, Eastern Flowering Dogwood, Green Dragon, Red Mulberry, Round-leaved Greenbrier, Shumard Oak, Spoon-leaved Moss, Spotted Wintergreen, Swamp Rose-mallow, Virginia Mallow, White Wood Aster

Snakes and Lizards
Common Five-lined Skink, Eastern Ribbonsnake, Gray Ratsnake, Massasauga

Turtles
Blanding's Turtle, Eastern Musk Turtle, Northern Map Turtle, Snapping Turtle, Spiny Softshell

I also used the Make a Map: Natural Heritage Areas tool:
http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US
This listed Cherry Birch, Black Snakeroot, Northern Hawthorn, Bird's-foot Violet, Cucumber Tree, Broad Beech Fern, Swamp rose-mallow, Sundial Lupine, and American Eel.

I also consulted the Conservation Ontario 2015 Aquatic Species at Risk maps: http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm
Here I discovered that the Deepwater Sculpin, Eastern Pondmussel, Grass Pickerel, Kidneyshell, Lake Chubsucker, Mapleleaf, Northern Brook Lamprey, Round Hickorynut, and Round Pigtoe are of concern.

I was wondering if there are any other species at risk I should consider as part of this assessment?

Thank you in advance for your assistance,
Sarah

SARAH TAYLOR, EIT
Environmental Group

Englobe
353 Bridge Street East
Kitchener (Ontario) N2K 2Y5
T 519.741.1313 ext 247 / cell. 519.616.0814
F 519.741.5422
sarah.taylor@englobecorp.com
www.englobecorp.com

Ministry of Natural Resources And Forestry

Ministère des Richesses naturelles et des Forets

Box 5000
4890 Victoria Ave. N.
Vineland Station, Ontario
LOR 2E0

Telephone: (905) 562-4147
Facsimile: (905) 562-1154

February 9, 2018

Sarah Taylor
Englobe
353 Bridge Street East
Kitchener, ON
N2K 2Y5
Sarah.Taylor@englobecorp.com

RE: Port Weller Phase I ESA
4 Welland Canals Parkway

Dear Ms. Taylor,

The Ministry of Natural Resources and Forestry (MNRF), Guelph District – Vineland Field Office, has reviewed the natural heritage information available for the above-noted property and surrounding area (the "study area"), and offers the following comments:

WETLANDS

The Ministry has identified no Provincially Significant Wetlands, however, the following other wetlands are adjacent to the study area:

- Welland Canal Seaway Wetland Other Significance

As requested, a copy of the wetland evaluation file for the Welland Canal Seaway Wetland is attached. Please be advised that wetland evaluation files are considered "open" files and may be updated from time to time as new information becomes available.

AREAS OF NATURAL AND SCIENTIFIC INTEREST

The Ministry notes that there are no Areas of Natural and Scientific Interest (ANSIs) within the study area.

FISHERIES

Restricted activity timing windows are applied to protect fish from impacts of undertakings in and around water during critical life cycle stages. The recommended timing restrictions for Lake Ontario are March 15th to July 15th and September 30th to November 15th (Note: dates represent when work should be avoided).

The MNRF notes that the fish species in the attached list have been documented in the area.

SPECIES AT RISK

There are records in the area for the following species at risk (SAR):

- Barn Swallow *(Hirundo rustica)* (Threatened)

- Bank Swallow *(Riparia riparia)* (Threatened)
- American Eel *(Anguilla rostrata)* (Endangered)
- Wood Thrush *(Hylocichla mustelina)* (Special Concern)
- Eastern Meadowlark *(Sturnella magna)* (Threatened)
- Bobolink *(Dolichonyx oryzivorus)* (Threatened)
- Prothonotary Warbler *(Protonotaria citrea)* (Endangered)
- Yellow-breasted Chat *(Icteria virens)* (Endangered)
- Horned Grebe (*Podiceps auritus*) (Special Concern)
- Red-headed Woodpecker (*Melanerpes erythrocephalus*) (Special Concern)
- Swamp Rose Mallow *(Hibiscus moscheutos)* (Special Concern)

The Ministry notes that there is no known habitat of any SAR within the study area.

Threatened and Endangered Species receive both individual species and habitat protection under the *Endangered Species Act, 2007* (ESA). SAR habitat prescribed under regulation is listed in Ont. Reg. 242/08 (https://www.ontario.ca/laws/regulation/080242).

Please be advised that because the province has not been surveyed comprehensively for the presence of listed species, the absence of a record does not necessarily indicate the absence of SAR from an area. To determine the presence of SAR for a given study area, the District's recommended approach is as follows:

I. Habitat Inventory

The Ministry recommends undertaking a comprehensive botanical inventory of the entire area that may be subject to direct and indirect impacts from the proposed activity. The vegetation communities should be classified as per the "Ecological Land Classification (ELC) for Southern Ontario" system, to either the "Ecosite" or "Vegetation Type" level. For aquatic habitats in the study area, we recommend that you collect data on the physical characteristics of the waterbodies and inventory the riparian zone vegetation, so that these habitats can be classified as per the Aquatic Ecosites described in the ELC manual.

II. Potential SAR within the Study Area

A list of SAR that have the potential to occur in the area can be produced by cross-referencing the ecosites described during the habitat inventory with the habitat descriptions of SAR known to occur within the planning area. The list of SAR known to occur in the **City of St Catharines** is attached for your reference. The species-specific COSEWIC status reports (https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html) are a good source of information on habitat needs and will be helpful in determining the suitability of the study areas ecosites for a given species.

Please note that the Species at Risk in Ontario (SARO) List is a living document that is periodically amended as a result of species assessment and re-assessments conducted by the Committee on the Status of Species at Risk in Ontario (COSSARO). The SARO List can be accessed on the following webpage: https://www.ontario.ca/environment-and-energy/species-risk-ontario-list.

COSSARO also maintains a list of species to be assessed in the future. It is recommended that you take COSSARO's list of anticipated assessments into consideration, especially when the proposed start date of an activity is more than 6 months away, or the project will be undertaken over a period greater than 6 months. This list can be viewed at: https://www.ontario.ca/page/how-comment-protecting-species-risk.

III. SAR Surveys

The Ministry recommends that each potential SAR identified under Step II is surveyed for, regardless of whether or not the species has been previously recorded in the area. The survey report should describe how each SAR was surveyed for, and provide a rationale for why certain species were not afforded a survey (e.g., habitat within the study area is not suitable for a specific SAR). Please note that some targeted surveys may require provincial authorizations (e.g., ESA permit or Wildlife Scientific Collector's Permit).

ADDITIONAL INFORMATION

Natural heritage features (e.g. wetlands, ANSIs) can be viewed for a given study area through the MNRF's "Make a Map" web application: https://www.ontario.ca/page/make-natural-heritage-area-map. Digital data layers can be obtained through the Land Information Ontario (LIO) geowarehouse https://www.ontario.ca/page/land-information-ontario.

Additionally, the MNRF recommends contacting the municipality and the conservation authority to determine if they have any additional information or records of interest for the study area.

Please be advised that it is your responsibility to comply with all other relevant provincial or federal legislation, municipal by-laws, other MNRF approvals or required approvals from other agencies. If your investigations reveal the presence of Threatened or Endangered species, please contact the MNRF at esa.guelph@ontario.ca for further direction.

I trust that the above information is of assistance.

Sincerely,

Elizabeth Reimer
A/Management Biologist

cc: Andrew Dunbrack

District Species Summary Listing

Exported on February 9, 2018 by reimerel

Species	First Found	Last Found	LIO Surveys	District Surveys
alewife	2003	2003	0	1
brown bullhead	2004	2004	0	1
Chinook salmon	2004	2004	0	1
emerald shiner	2000	2004	0	6
gizzard shad	2000	2003	0	2
golden shiner	2004	2004	0	1
largemouth bass	2004	2004	0	1
rainbow smelt	2004	2004	0	1
rainbow trout	2004	2004	0	1
rock bass	2004	2004	0	2
round goby	2003	2004	0	4
rudd	2003	2003	0	1
spottail shiner	2000	2004	0	4
white perch	2000	2004	0	5
white sucker	2004	2004	0	2
yellow perch	2003	2004	0	2

St. Catharines

Date Generated: February 9, 2018

Bird	SARO	Protection	Habitat Information	Timing Windows	Survey Protocol
Acadian Flycatcher *Empidonax virescens*	END	Species Protection and General Habitat Protection	Generally requires large areas of mature, undisturbed forest; avoids the forest edge; often found in well wooded swamps and ravines.	Migrate South before Winter	Follow Breeding Bird Survey Protocol
Bank Swallow *Riparia riparia*	THR	Species Protection and General Habitat Protection	It nests in a wide variety of naturally and anthropogenically created vertical banks, which often erode and change over time including aggregate pits and the shores of large lakes and rivers.	Migrate South before Winter	Follow Breeding Bird Survey Protocol. Colony and Roost information should be recorded and submitted using Bird Studies Canada's Ontario Bank Swallow Project data forms (2010).
Barn Owl *Tyto alba*	END	Species Protection and Habitat Regulation	Generally prefer low-elevation, open country; often associated with agricultural lands, especially pasture. Nests are located in buildings, hollow trees and cavities in cliffs.	Active Year Round Some leave for the Winter	Follow Breeding Bird Survey Protocol Night surveys may be helpful as they are very vocal
Barn Swallow *Hirundo rustica*	THR	Species Protection and General Habitat Protection	Prefers farmland; lake/river shorelines; wooded clearings; urban populated areas; rocky cliffs; and wetlands. They nest inside or outside buildings; under bridges and in road culverts; on rock faces and in caves etc.	Migrate South before Winter	Follow Breeding Bird Survey Protocol
Black Tern *Chlidonias niger*	SC	N/A	Generally prefer freshwater marshes and wetlands; nest either on floating material in a marsh or on the ground very close to water	Migrate South for the Winter	Follow Breeding Bird Survey Protocol
Bobolink *Dolichonyx oryzivorus*	THR	Species Protection and General Habitat Protection	Generally prefers open grasslands and hay fields. In migration and in winter uses freshwater marshes and grasslands	Migrate South for the Winter	Contact MNR Guelph District Management Biologist to obtain a copy of the protocol

Canada Warbler *Cardellina canadensis*	SC	N/A	Generally prefers wet coniferous, decidiuous and mixed forest types, with a dense shrub layer. Nests on the ground, on logs or hummocks, and uses dense shrub layer to conceal the nest.	Arrive in Early May Migrate South for the Winter	Follow Breeding Bird Survey Protocol
Cerulean Warbler *Setophaga cerulea*	THR	Species Protection and General Habitat Protection	Generally found in mature deciduous forests with an open understorey; also nests in older, second-growth deciduous forests.	Migrate South for the Winter	Follow Breeding Bird Survey Protocol
Chimney Swift *Chaetura pelagica*	THR	Species Protection and General Habitat Protection	Historically found in deciduous and coniferous, usually wet forest types, all with a well developed, dense shrub layer; now most are found in urban areas in large uncapped chimneys	Nesting - Late April to Mid-May Migrate South in September or Early October	Chimney Swift Monitoring Protocol. Bird Studies Canada, March 2009
Common Nighthawk *Chordeiles minor*	SC	N/A	Generally prefer open, vegetation-free habitats, including dunes, beaches, recently harvested forests, burnt-over areas, logged areas, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores, and river banks. This species also inhabits mixed and coniferous forests. Can also be found in urban areas (nest on flat roof-tops).	Migrate South for the Winter	Contact MNR Guelph District Management Biologist to obtain a copy of the protocol
Eastern Meadowlark *Sturnella magna*	THR	Species Protection and General Habitat Protection	Generally prefers grassy pastures, meadows and hay fields. Nests are always on the ground and usually hidden in or under grass clumps.	Migrate South for the Winter	Contact MNR Guelph District Management Biologist to obtain a copy of the protocol
Eastern Whip-poor-will *Caprimlugus vociferus*	THR	Species Protection and General Habitat Protection	Generally prefer semi-open deciduous forests or patchy forests with clearings; areas with little ground cover are also preferred; In winter they occupy primarily mixed woods near open areas.	Nesting: May - July	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol

Eastern Wood-Pewee *Contopus virens*	SC	N/A	Associated with deciduous and mixed forests. Within mature and intermediate age stands it prefers areas with little understory vegetation as well as forest clearings and edges.	Migrate South for the Winter	Follow Breeding Bird Survey Protocol
Golden-winged Warbler *Vermivora chrysoptera*	SC	N/A	Generally prefer areas of early successional vegetation, found primarily on field edges, hydro or utility right-of-ways, or recently logged areas.	Migrate South for the Winter	Follow Breeding Bird Survey Protocol
Peregrine Falcon *Falco peregrinus*	SC	N/A	Generally nest on tall, steep cliff ledges adjacent to large waterbodies; some birds adapt to urban environments and nest on ledges of tall buildings, even in densely populated downtown areas.	Active Year Round - Lay Eggs around Easter Hatching occurs around Mother's Day Young fledge around Father's	Visit ideal habitat locations and listen/look for individuals in the vicinity.
Red-Headed Woodpecker *Melanerpes erythrocephalus*	SC	N/A	Generally prefer open oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, urban parks, golf courses, cemeteries, as well as along beaver ponds and brooks	Active from May to September	Follow Breeding Bird Survey Protocol
Wood Thrush *Hylocichla mustelina*	SC	N/A	Nests mainly in second-growth and mature deciduous and mixed forests, with saplings and well-developed understory layers. Prefers large forest mosaics, but may also nest in small forest fragments.	Migrate South for the Winter Arrive in Ontario in mid to late spring	Follow Breeding Bird Survey Protocol
Yellow-breasted Chat *Icteria virens*	END	Species Protection and General Habitat Protection	Generally prefer dense thickets around wood edges, riparian areas, and in overgrown clearings	Migrate South for the Winter Arrive in Ontario Early May	Follow Breeding Bird Survey Protocol

Fish	SARO	Protection	Habitat Information	Timing Windows	Survey Protocol

American Eel *Anguilla rostrata*	END	Species Protection and General Habitat Protection	All fresh water, estuaries and coastal marine waters that are accessible to the Atlantic Ocean; 12-mile Creek watershed and Lake Ontario	Active Year Round	Electrofishing For information please contact your local MNRF office, CA or DFO

Insect	SARO	Protection	Habitat Information	Timing Windows	Survey Protocol
Monarch Butterfly *Danaus plexippus*	SC	N/A	Exist primarily wherever milkweed and wildflowers exist; abandoned farmland, along roadsides, and other open spaces	Usually migrate south in late September and October	Watch for adults along roadsides and in open fields. Caterpillars feed on milkweeds: Common milkweed grows in open disturbed habitats (fields, roadsides, etc) and swamp milkweed grows in wet habitats (along streams, lakes, marshes) Adults can be spotted from a distance; caterpillars must be looked for carefully on the host plant.
Rusty-patched Bumble Bee *Bombus affinis*	END	Species Protection and General Habitat Protection	Generally inhabits a range of diverse habitats including mixed farmland, sand dunes, marshes, urban and wooded areas. It usually nests underground in abandoned rodent burrows	Active from early Spring to late Fall	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
West Virginia White *Pieris virginiensis*	SC	N/A	Generally prefer moist, deciduous woodlands. The larvae feed only on the leaves of the two-leaved toothwort (Cardamine diphylla), which is a small, spring-blooming plant of the forest floor.	Adult butterfly emerges from pupa in late March; flies only in April and May	Watch for adults within moist, deciduous woodlands Caterpillars feed on the two-leaved toothwort: Toothwort grows in damp, open, rich hardwood woodlands and blooms from April to June. Adults can be spotted from a distance; caterpillars must be searched for carefully by checking host plant

Mammal	SARO	Protection	Habitat Information	Timing Windows	Survey Protocol
Eastern Small-footed Myotis *Myotis leibii*	END	Species Protection and General Habitat Protection	Overwintering habitat: Caves and mines that remain above 0 degrees Celsius Maternal Roosts: primarily under loose rocks on exposed rock outcrops, crevices and cliffs, and occasionally in buildings, under bridges and highway overpasses and under tree bark.	Hibernates in caves and mines during winter	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol

Gray Fox *Urocyon cinereoargenteus*	THR	Species Protection and General Habitat Protection	Generally prefers deciduous forests, marshes, swampy areas, and urban areas	Active Year Round	Opportunistically or by examining tracks in winter and summer
Little Brown Myotis *Myotis lucifugus*	END	Species Protection and General Habitat Protection	Overwintering habitat: Caves and mines that remain above 0 degrees Celsius Maternal Roosts: Often associated with buildings (attics, barns etc.). Occasionally found in trees (25-44 cm dbh).	Hibernates during winter	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
Northern Myotis *Myotis septentrionalis*	END	Species Protection and General Habitat Protection	Overwintering habitat: Caves and mines that remain above 0 degrees Celsius Maternal Roosts: Often asssociated with cavities of large diameter trees (25-44 cm dbh). Occasionally found in structures (attics, barns etc.)	Hibernates during winter	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol
Tri-colored Bat *Perimyotis subflavus*	END	Species Protection and General Habitat Protection	Overwintering habitat: Caves and mines that remain above 0 degrees Celsius Maternal Roosts: Can be in trees or dead clusters of leaves or arboreal lichens on trees. May also use barns or similar structures.	Hibernates during winter	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol

Plant	SARO	Protection	Habitat Information	Timing Windows	Survey Protocol
American Chestnut *Castanea dentata*	END	Species Protection and General Habitat Protection	Found in deciduous forest communities; this tree prefers arid forests with acid and sandy soils.	Flowers occur in Late Spring and Early Summer	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species Perform detailed floristic inventory Look for distinictive fruits on the ground
American Columbo *Frasera caroliniensis*	END	Species Protection and General Habitat Protection	Most commonly associated with open deciduous forested slopes, thickets and clearings; grows in a variety of relatively stable habitats as well as on a wide variety of soils.	Germination and development of the rosette begin in early spring Flowers open in May Fruit production continues	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species Look for spikes from last years flowers

American Ginseng *Panax quinquefolius*	END	Species Protection and General Habitat Protection	Grows in rich, moist, undisturbed and relatively mature deciduous woods in areas of neutral soil (such as over limestone or marble bedrock).	Flowering begins in June and continues until August The fruit develop from July to August and ripen in August and September	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species
Butternut *Juglans cinerea*	END	Species Protection and General Habitat Protection	Generally grows in rich, moist, and well-drained soils often found along streams. It may also be found on well-drained gravel sites, especially those made up of limestone. It is also found, though seldomly, on dry, rocky and sterile soils. In Ontario, the Butternut generally grows alone or in small groups in deciduous forests as well as in hedgerows	Flowers from April to June. Fruits reach maturity during the month of September or October	Walk slowly and systematically in grid fashion through suitable habitat pausing every 30 meters for a detailed scan of trees within sight. Areas with dense foliage or many saplings will require a more intensive survey to detect sapling butternut. Use Butternut Health Assessment Protocol if planning on removing trees.
Cherry Birch *Betula lenta*	END	Species Protection and General Habitat Protection	Generally grows in moist, well-drained soils, but it is also found on coarse-textured or rocky shallow soils.	Flowering occurs in the spring, before the leaves appear	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species
Cucumber Tree *Magnolia acuminata*	END	Species Protection and General Habitat Protection	Generally grows in rich, well-drained soils in deciduous forest habitats	Flowering occurs in late May Fruits appear in Late Summer	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species
Eastern Flowering Dogwood *Cornus florida*	END	Species Protection and Habitat Regulation	Generally grows in deciduous and mixed forests, in the drier areas of its habitat, although it is occasionally found in slightly moist environments; Also grows around edges and hedgerows	Flowering occurs in mid-May, just as the leaves begin to develop. Fruit turns red at the end of summer.	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species Easiest to detect during Spring when in flower Also look for distinctive bark

Red Mulberry *Morus rubra*	END	Species Protection and General Habitat Protection	Generally grows in moist forest habitats. In Ontario, these include slopes and ravines of the Niagara Escarpment, and sand spits and bottom lands; Can grow in open areas such as hydro corridors	Flowering occurs when leaves emerge in late spring. Fruit emerges in Mid-July.	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from the similar White Mulberry Distinguishing Red Mulberry and the hybrid Red and White Mulberry will require the collection of leaves for generic testing, which requires a 17(2)(b) permit
Swamp Rose-mallow *Hibiscus moscheutos*	SC	N/A	Generally grows in open, coastal marshes, but it is also sometimes found in open wet woods, thickets and drainage ditches	Flowering occurs between the end of July and the middle of September	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species
White Wood Aster *Eurybia divaricata*	THR	Species Protection and General Habitat Protection	Generally grows in open, dry, deciduous forests. It has been suggested that it may benefit from some disturbance, as it often grows along trails.	Flowering occurs in early September, and sets fruit later in the month	Walk slowly and systematically in grid fashion, pausing to scan for plants every 5 meters Use a plant field guide to distinguish from similar species
Reptile	**SARO**	**Protection**	**Habitat Information**	**Timing Windows**	**Survey Protocol**
Common Five-lined Skink *Plestiodon fasciatus*	END	Species Protection and Habitat Regulation	Generally occur near dunes, fields, and deciduous forests. This species is generally associated with relatively open environments.	Active from mid-April to late September or early October	Watch for individuals sunning themselves on rocks (or trees) Lift rocks and downed woody debris carefully to avoid disturbing skinks or their eggs Avoid handling individuals; If disturbed, they can lose their tail as a defence strategy.
Eastern Ribbonsnake *Thamnophis sauritus*	SC	N/A	Generally occur along the edges of shallow ponds, streams, marshes, swamps, or bogs bordered by dense vegetation that provides cover. Abundant exposure to sunlight is also required, and adjacent upland areas may be used for nesting.	Hibernate: October - April Mating: Early Spring Hatching: Early Fall (September)	Contact MNRF Guelph District Management Biologist to obtain a copy of the protocol

Snapping Turtle *Chelydra serpentina*	SC	N/A	Generally inhabit shallow waters where they can hide under the soft mud and leaf litter. Nesting sites usually occur on gravely or sandy areas along streams. Snapping Turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.	Nesting: Late May and June Hibernate: October - April	Scan offshore rocks and logs for basking turtles (10am-2pm) Snorkel in desired aquatic habitat Nesting Season: Search known or preferred nesting habitat areas for females

Welland Canal Seaway Wetland

Wetland Evaluation Edition	3rd

January 0, 1900

Comments

The following evaluation was completed using polygon information derived from a "Geographic Information Layer" provided by the Guelph District Office . The wetland polygon's were identified from 2002 & 2006 Colour Ortho aerial photography.

Additional Information

Include relevant information that can not be entered in the wetland data record(Ex. Sections that have not been completed.)

Official Name:	Welland Canal Seaway Wetland				
Evaluation Edition:	3rd	Class:		Wetland ID.:	
Wetland Significance	Year/Month Last Evaluated			January 0, 1900	
	Year/Month Last Updated				

Special Planning Considerations:		Scores	
Wetland Area:	3.97	Biological:	88
Dentention Area:	181.29	Social:	72
Catchment Area:	6367.76	Hydrological:	114
OMNR Source	Niagara Area Biologist: A.Yagi: 2011	Special Features:	83
Information Source	Field Observations: Drabick/Yagi: 2011	Overall:	357
Submitted by:	Ron Drabick		
Date:			

INVESTIGATORS	AFFILIATION
R.Drabick, A.Yagi: 2011	OMNR

DATES WETLAND VISITED

August 5, 2011

DATE THIS EVALUATION COMPLETED:

ESTIMATED TIME DEVOTED TO COMPLETING THE FIELD SURVEY IN "PERSON HOURS"

2011: 3 ph

WEATHER CONDITIONS

i) at time of field work Sunny Clear 32 deg C.

(Continue in the space below if necessary)

ii) summer conditions in general Variable: Cool to extremely hot

OTHER POTENTIALLY USEFUL INFORMATION:

CHECKLIST OF PLANT AND ANIMAL SPECIES RECORDED IN THE WETLAND:

Attach a list of all flora and fauna observed in the wetland.

*Indicate if voucher specimens or photos have been obtained, where located, etc.

Wetland Manual

WETLAND DATA AND SCORING RECORD

i) **WETLAND NAME:** **Welland Canal Seaway Wetland**

ii) **MNR ADMINISTRATIVE REGION:** **Central** **DISTRICT:** **Guelph**

AREA OFFICE (if different from District): **Niagara (Vineland)**

iii) **CONSERVATION AUTHORITY JURISDICTION:** **Niagara Peninsula C.A.**

(If not within a designated CA, check here: _____

iv) **COUNTY OR REGIONAL MUNICIPALITY:** **R.M. of Niagara**

v) **TOWNSHIP:** **City of St. Catharines (Grantham)**

vi) **LOTS & CONCESSIONS:** **Conc. Broken Front, Lot 11**
(attach separate sheet if necessary)

vii) **MAP AND AIR PHOTO REFERENCES**

a) Latitude: **43-13-59** Longitude: **79-12-47**

b) UTM grid reference: Zone: **17T** Block: **n/a**
Grid:E **n/a** Grid:N **n/a**

c) National Topographic Series:

map name(s) **Niagara**

map number(s) **030M03** edition **7th**

scale **1 : 50,000**

d) Aerial photographs: Date photo taken: **2002/2006** Scale: **Varible**

Flight & plate numbers: **2002 G.T.A. Colour Ortho Aerial Photography**
2006 R.of Niagara Colour Ortho Aerial Photography

(attach separate sheet if necessary)

e) Ontario Base Map numbers & scale **1 : 10,000**

10-17-6400-47850; 10-17-6450-47850
(attach separate sheets if necessary)

Data Summery Form Code:
Wetland Name:

WETLAND UNIT #	DOMINATE FORM	WETLAND TYPE	COMMUNITY CODE	COMMUNITY SUB_CODE	AREA (ha)	SITE TYPE	SOIL	FORMS	# OF FORMS	% OPEN WATER	ha OPEN WATER	FISH HABITAT (LM / HM)	Dominate Species	Additional Species	COMMENTS
1	h	Swamp	1		3.97	Palustrine	clay/loam	h,ts,gc	3		-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
											-				
					3.97						-				

viii) WETLAND SIZE AND BOUNDARIES

a) Single contiguous wetland area: 3.97 hectares

b) Wetland complex comprised of _____ individual wetlands:

Wetland Unit Number (for reference)		Size of each wetland unit Ha
Wetland Unit No.	1	3.97
Wetland Unit No.	2	0.00
Wetland Unit No.	3	0.00
Wetland Unit No.	4	0.00
Wetland Unit No.	5	0.00
Wetland Unit No.	6	0.00
Wetland Unit No.	7	0.00
Wetland Unit No.	8	0.00
Wetland Unit No.	9	0.00
Wetland Unit No.	10	0.00
Wetland Unit No.	11	0.00
Wetland Unit No.	12	0.00
Wetland Unit No.	13	0.00
Wetland Unit No.	14	0.00
Wetland Unit No.	15	0.00
Wetland Unit No.	16	0.00
Wetland Unit No.	17	0.00
Wetland Unit No.	18	0.00
Wetland Unit No.	19	0.00
Wetland Unit Totals:		3.97

(Attach additional sheets if necessary)

TOTAL WETLAND SIZE 3.97

c) Brief documentation of reasons for including any areas less than 0.5 ha in size:

(Attach separate sheets if necessary .)

1.0 BIOLOGICAL COMPONENT

1.1 PRODUCTIVITY

1.1.1 GROWING DEGREE-DAYS/SOILS

GROWING DEGREE DAYS (check one)		MAP
1)		<2800
2)		2800 -3200
3)		3200 -3600
4)	X	3600 -4000
5)		>4000

SOILS Estimated Fractional Area	
1.00	clay/loam
0.00	silt/marl
0.00	limestone
0.00	sand
0.00	humic/mesic
0.00	fibric
0.00	granite

Determine the soil type from the appropriate OMAF soils maps

SCORING:

Growing Degree-Days	Clay-Loam	Silt-Marl	Lime-stone	Sand	Humic-Mesic	Fibric	Granite
<2800	15	13	11	9	8	7	5
2800-3200	18	15	13	11	9	8	7
3200-3600	22	18	15	13	11	9	7
3600-4000	**26**	21	18	15	13	10	8
>4000	30	25	20	18	15	12	8

(maximum score 30; if wetland contains more than one soil type, evaluate based on the fractional area)

Steps required for evaluation: (maximum score 30 points)

1. Select GDD line in evaluation table applicable to your wetland;
2. Determine fractional area of the wetland for each soil type;
3. Multiply fractional area of each soil type by score;
4. Sum individual soil type scores (round to nearest whole number).

In wetland complexes the evaluator should aim at determining the percentage of area occupied by the categories for the complex as a whole.

Score		
26	clay/loam	26.00
	silt/marl	0.00
	limestone	0.00
	sand	0.00
	humic/mesic	0.00
	fibric	0.00
	granite	0.00

Final Score Growing Degree-Days/Soils (maximum 30 points) 26

1.1.2 WETLAND TYPE (Fractional Area = area of wetland type/total wetland area)

Estimate the Wetland Type from air photos or default to "swamp" (8)

	Fractional Area		Score
Bog	0.00	x 3	0.0
Fen	0.00	x 6	0.0
Swamp	1.00	x 8	8.0
Marsh	0.00	x 15	0.0
		Subtotal:	8.0

Wetland type score (maximum 15 points) 8

1.1.3 SITE TYPE (Fractional Area = area of site type/total wetland area)

Estimate from air photos

	Fractional Area		Score
Isolated	0.00	x 1 =	0.00
Palustrine (permanent or intermittent flow)	1.00	x 2 =	2.00
Riverine	0.00	x 4 =	0.00
Riverine (at rivermouth)	0.00	x 5 =	0.00
Lacustrine (at rivermouth	0.00	x 5 =	0.00
Lacustrine (on enclosed bay, with barrier beach)	0.00	x 3 =	0.00
Lacustrine (exposed to lake)	0.00	x 2 =	0.00
		Sub Total:	2.00

Site Type Score (maximum 5 points) 2

1.2 BIODIVERSITY

1.2.1 NUMBER OF WETLAND TYPES

(Check only one)			Score
1)	9	one	9 points
2)		two	13
3)		three	20
4)		four	30

Number of Wetland Types Score (maximum 30 points) 9

1.2.2 VEGETATION COMMUNITIES Veg Ref

Attach a separate sheet listing community (map) codes,vegetation forms and dominant species.
Use the form on the following page to record percent area by dominant vegetation form. This information will be used in other parts of the evaluation.

Communities should be grouped by number of forms. For example, 2 form communities might appear as follows:

2 forms

Code	Forms		Dominant Species				
M6	re,	ff	re,	*Typha latifolia;*	ff,	*Lemna minor,*	*Wolffia*
S1	ts,	gc	ts,	*Salix discolor;*	gc,	*lmpatiens capensis,*	*Thelypteris palustris*

Note that the dominant species for each form are separated by a semicolon. The dominant species (maximum of 2) within a form are separated by commas.

Scoring:

Total # of communities with 1-3 forms	Total # of communities with 4 -5 forms	Total # of communities with 6 or more forms
1 = 1.5 points	1 = 2 points	1 = 3 points
2 = 2.5	2 = 3.5	2 = 5
3 = 3.5	3 = 5	3 = 7
4 = 4.5	4 = 6.5	4 = 9
5 = 5	5 = 7.5	5 = 10.5
6 = 5.5	6 = 8.5	6 = 12
7 = 6	7 = 9.5	7 = 13.5
8 = 6.5	8 = 10.5	8 = 15
9 = 7	9 = 11.5	9 = 16.5
10 = 7.5	10 = 12.5	10 = 18
11 = 8	11 = 13	11 = 19
+.5 each additional community = 1.5	+.5 each additional community =	+ 1 each additional community =

e.g., a wetland with 3 one form communities 4 two form communities 12 four form communities and 8 six form communities would score:

6 + 13.5 + 15 = 34.5 = 35 points SubTotal: 2

Vegetation Communities Score (maximum 45 points) 2

Wetland Name: Welland Canal Seaway Wetland

Wetland Size (ha): 3.97

Vegetation Form	% area in which form is dominant
h	100.00
c	0.00
dh	0.00
dc	0.00
ts	0.00
ls	0.00
ds	0.00
gc	0.00
m	0.00
ne	0.00
be	0.00
re	0.00
ff	0.00
f	0.00
su	0.00
u (unvegetated)	0.00
Total = 100%	100.00

1.2.3 DIVERSITY OF SURROUNDING HABITAT

(Check all appropriate items(1))

Determine from air photos

1	row crop
1	pasture
1	abandoned agricultural land
1	deciduous forest
	coniferous forest
	mixed forest (at least 25% conifer and 75% deciduous or vice versa)
	abandoned pits and quarries
1	open lake or deep river
	fence rows with cover, or shelterbelts
	terrain appreciably undulating,hilly,or with ravines
	creek flood plain
5	Subtotal

Diversity of Surrounding Habitat Score (1 for each, maximum 7 points) 5

1.2.4 PROXIMITY TO OTHER WETLANDS

(Check first appropriate category only) Scoring

Determine from air photos and other wetlands evaluations in the vicinity

1)	8	Hydrologically connected by surface water to other wetlands (different dominant wetlaI1d type) or to open lake or deep river within 1.5 km — 8 points
2)		Hydrologically connected by surface water to other wetlands (same dominant wetland type) within 0.5 km — 8
3)		Hydrologica11y connected by surface water to other wetlands (different dominant wetland type),or to open lake or deep river from 1.5 to 4 km away — 5
4)		Hydrologically connected by surface water to other wetlands (same dominant wetland type) from 0.5 to 1.5 km away — 5
5)		Within 0.75 km of other wetlands (different dominant wetland type) or open water body, but not hydrologically connected by surface water — 5
6)		Within 1 km of other wetlands,but not hydrologically connected by surface water — 2
7)		No wetland within 1 km — 0

Proximity to other Wetlands Score (Choose one only, maximum 8 points) 8

Hydrologically connected to Lake Ontario

1.2.5 INTERSPERSION

Optional: Complete as time permits or as scoring dictates.

Number of Intersections (Check one)			Score
1)	26 or less		3
2)	27 to 40		6
3)	41 to 60	9	9
4)	61 to 80		12
5)	81 to l00		15
6)	101 to 125		18
7)	126 to 150		21
8)	151 to 175		24
9)	176 to 200		27
10)	>200		30

Interspersion Score (Choose one only maximum 30 points) 9

1.2.6 OPEN WATER TYPES Ref

Determine from aerial photos.

Permanently flooded: (Check one)			Score
1)		type 1	8
2)		type 2	8
3)	14	type 3	14
4)		type 4	20
5)		type 5	30
6)		type 6	8
7)		type 7	14
8)		type 8	3
9)		no open water	0

Open Water Type Score (Choose one only maximum 30 points) 14

1.3 SIZE

Score may be lower than actual if "Vegetation Community and Interspersion" have not been calculated.

4.0 hectares 47 Subtotal for Biodiversity

Size Score (Biological Component) (maximum 5O points) 5

Evaluation Table Size Score (Biological component)

Wetland size (ha)	Total Score for Biodiversity Subcomponent									
	<37	37-48	49-60	61-72	73-84	85-96	97-108	109-120	121-132	>132
<21 ha	1	**5**	7	8	9	17	25	34	43	50
21-40	5	7	8	9	10	19	28	37	46	50
41-60	6	8	9	10	11	21	31	40	49	50
61-80	7	9	10	11	13	23	34	43	50	50
81-100	8	10	11	13	15	25	37	46	50	50
101-120	9	11	13	15	18	28	40	49	50	50
121-140	10	13	15	17	21	31	43	50	50	50
141-160	11	15	17	19	23	34	46	50	50	50
161-180	13	17	19	21	25	37	49	50	50	50
181-200	15	19	21	23	28	40	50	50	50	50
201-400	17	21	23	25	31	43	50	50	50	50
401-600	19	23	25	28	34	46	50	50	50	50
601-800	21	25	28	31	37	49	50	50	50	50
801-1000	23	28	31	34	40	50	50	50	50	50
1001-1200	25	31	34	37	43	50	50	50	50	50
1201-1400	28	34	37	40	46	50	50	50	50	50
1401-1600	31	37	40	43	49	50	50	50	50	50
1601-1800	34	40	43	46	50	50	50	50	50	50
1801-2000	37	43	47	49	50	50	50	50	50	50
>2000	40	46	50	50	50	50	50	50	50	50

2.0 SOCIAL COMPONENT

2.1 ECONOMICALLY VALUABLE PRODUCTS

2.1.1 WOOD PRODUCTS

Determine the percentage of the wetland area dominated by "h" or "c" by using aerial photograph.

Area of wetland forested (ha), i.e. dominant form is h or c. Note that this is not wetland size. (Check one only)

h:	3.97	c:	0.00

			Score
1)	0	<5 ha	0
2)		5 -25 ha	3
3)		26 -50 ha	6
4)		51- l00 ha	9
5)		101 -200 ha	12
6)		>200 ha	18

Source of information: Field Observations: Drabick/Yagi: 2011

Wood Products Score (Score one only, maximum 18 points) 0

2.1.2 WILD RICE

(Check one)			Score (Choose one)
Present (minimum size 0.5 ha)	1)		6 points
Absent	2)	0	0

Source of information: Field Observations: Drabick/Yagi: 2011

Wild Rice Score (maximum 6 points) 0

2.1.3 COMMERCIAL FISH (BAIT FISH AND/OR COARSE FISH

(Check one)			Score (Choose one)
Present	1)		12 points
Habitat not suitable for fish	2)	0	0

Source of infolmation: Niagara Area Biologist: A.Yagi: 2011

If any part of the wetland is riverine or the District fisheries files indicate presence of fish score"present"

Commercial Fish Score (maximum 12 points) 0

2.1.4 BULLFROGS

(Check one)			Score (Choose one)
Present	1)		1 points
Absent	2)	0	0

Source of information: Field Observations: Drabick/Yagi: 2011

Bullfrog Score (maximum 1 point) 0

Wetlands Manual

2.1.5 SNAPPING TURTLES

(Check one)			Score (Choose one)
Present	1)		1 point
Absent	2)	0	0

Source of information: Field Observations: Drabick/Yagi: 2011

Snapping Turtle Score (maximum 1 point) 0

2.1.6 FURBEARERS Fur Ref

(Consult Appendix 9)

	Name of furbearer		Source of information
1)	Raccoon	3	Field Observations: Drabick/Yagi: 2011
2)	Virginia Opossum	3	Niagara Rabies Trap Data
3)	Red Fox	3	Niagara Rabies Trap Data
4)	Coyote	3	Field Observations: Drabick/Yagi: 2011
5)	Mink/Muskrat		Field Observations: Drabick/Yagi: 2011
	SubTotal	12	

Scoring: 3 points for each species. maximum 12

Furbearer Score (maximum 12 points) 12

2.2 RECREATIONAL ACTIVITIES

Type of Wetland-Associated Use							
Intensity of Use	Hunting		Nature Enjoyment/ Ecosystem Study		Fishing		
High	40 points		40 points		40 points		
Moderate	20		20		20		
Low	8		8	8	8		
Not possible/NotKnown	0	0	0		0	0	
Totals		0		8		0	8

(score one level for each of the three wetland uses; scores are cumulative; maximum score 80 points)

Sources of information:

Hunting: Field Observations: Drabick/Yagi: 2011

Nature: Field Observations: Drabick/Yagi: 2011

Fishing: Field Observations: Drabick/Yagi: 2011

Recreational Activities Score (maximum 80 points) 8

2.3 LANDSCAPE AESTHETICS

Score using ortho-aerial photography

2.3.1 DISTINCTNESS

(Check one)			Score (Choose one)
Clearly distinct	1)		3 points
Indistinct	2)	0	0

Landscape Distinctness Score (maximum 3 points) 0

2.3.2 ABSENCE OF HUMAN DISTURBANCE

(Check one)			Score (Choose one)
Human disturbances absent or nearly so	1)		7 points
One or several localized disturbances	2)		4
Moderate disturbance; localized water pollution	3)	2	2
Wetland intact but impairment of ecosystem quality intense in some areas	4)		1
Extreme ecological degradation, or water pollution severe and widespread	5)		0

Source of information: Field Observations: Drabick/Yagi: 2011

Road/building construction,filling,dumping,water pollution,timber harvesting

Absence of Human Disturbance Score (maximum 7 points) 2

2.4 EDUCATION AND PUBLIC AWARENESS

Optional: complete as time and scoring dictates.

2.4.1 EDUCATIONAL USES

(Check one)			Score (Choose one)
Frequent	1)		20 points
Infrequent	2)		12
No visits	3)	0	0

Source of information: Field Observations: Drabick/Yagi: 2011

Requires contact with Local Boards of Education.

Educational Uses Score (maximum 20 points) 0

2.4.2 FACILITIES AND PROGRAMS

(check one)			Score (Choose one)
Staffed interpretation centre	1)		8 points
No interpretation centre or staff but a system of self-guiding trails or brochures available	2)		4
Facilities such as maintained paths (e.g., woodchips) boardwalks, boat launches or observation towers but no brochures or other interpretation	3)	2	2
No facilities or programs	4)		0

Source of information: Field Observations: Drabick/Yagi: 2011

Facilities and Programs Score (maximum 8 points) 2

2.4.3 RESEARCH AND STUDIES

(check appropriate spaces)		Score
Long term research has been done		12 points
Research papers published in refereed scientific journal or as a thesis		10
One or more (non-research) reports have been written on some aspect of the wetland ' s flora fauna hydrology etc.		5
No research or reports		0
Subtotal:	0	

Attach list of known reports by above categories

Refer to ESPA, EPA and ANSI reports.

Research and Studies Score (Score is cumulative, maximum 12 points) 0

2.5 PROXIMITY TO AREAS OF HUMAN SETTLEMENT

Circle the highest applicable score

Distance of wetland from settlement	1) population> 10,000		2) population 2,500 -10,000		3) population <2,500 or cottage community	
1) Within or adjoining settlement	40 points	40	26		16	
2) 0.5 to 10 km from settlement	26		16		10	
3) 10 to 60 km from settlement	12		8		4	
4) >60 km from settlement	5		2		0	
		40		0		0

Name of settlement: City of St. Catharines

Proximity to Human Settlement Score (maximum 40 points) 40

2.6 OWNERSHIP (FA= fraction Area) Score

Select a default value of "4" if no other information exists.

FA of wetland in public or private ownership held under contract or in trust for wetland protection		x	10	=	0.00
FA of wetland area in public ownership,not as above		x	8	=	0.00
FA of wetland area in private ownership,not as above	1.00	x	4	=	4.00

Source of information: Guelph GIS Parcel layer:

Ownership Score (maximum 10 points) 4

Additional Reports

2.7 SIZE

The score may be lower than actual since economic and recreational values have not been completed.

4.0 hectares 60 Subtotal for Social

Evaluation Table for Size Score (Social Component)

Wetland Size (ha)	Total for Size Dependent Score									
	<31	31-45	46-60	61-75	76-90	91-105	106-120	121-135	136-150	>150
<2 ha	1	2	4	8	10	12	14	14	14	15
2 - 4ha	1	2	**4**	8	12	13	14	14	15	16
5 - 8ha	2	2	5	9	13	14	15	15	16	16
9 - 12ha	3	3	6	10	14	15	15	16	17	17
13-17	3	4	7	10	14	15	16	16	17	17
18-28	4	5	8	11	15	16	16	17	17	18
29-37	5	7	10	13	16	17	18	18	19	19
38-49	5	7	10	13	16	17	18	18	19	20
50-62	5	8	11	14	17	17	18	19	20	20
63-81	5	8	11	15	17	18	19	20	20	20
82-105	6	9	11	15	18	18	19	20	20	20
106-137	6	9	12	16	18	19	20	20	20	20
138-178	6	9	13	16	18	19	20	20	20	20
179-233	6	9	13	16	18	20	20	20	20	20
234-302	7	9	13	16	18	20	20	20	20	20
303-393	7	9	14	17	18	20	20	20	20	20
394-511	7	10	14	17	18	20	20	20	20	20
512-665	7	10	14	17	18	20	20	20	20	20
666-863	7	10	14	17	19	20	20	20	20	20
864-1123	8	12	15	17	19	20	20	20	20	20
1124-1460	8	12	15	17	19	20	20	20	20	20
1461-1898	8	13	15	18	19	20	20	20	20	20
1899-2467	8	14	16	18	20	20	20	20	20	20
>2467	8	14	16	18	20	20	20	20	20	20

Total Size Score (Social Component) 4.0

2.8 ABORIGINAL AND CULTURAL HERITAGE VALUES

Either or both Aboriginal or Cultural Values may be scored. However, the maximum score permitted for 2.8 is 30 points. Attach documentation.

2.8.1 ABORIGINAL VALUES

Full documentation of sources must be attached to the data record.

1)	Significant		=	30 points
2)	Not Significant		=	0
3)	Unknown	0.0	=	0
	Total:	0		

2.8.2 CULTURAL HERITAGE

1)	Significant		=	30 points
2)	Not Significant		=	0
3)	Unknown	0.0	=	0
	Total:	0		

Aboriginal Values/Cultural Heritage Score (maximum 30 points) 0.0

3.0 HYDROLOGICAL COMPONENT

3.1 FLOOD ATTENUATION

Estimated&Calculated values can be obtained from G.I.S. data layers.

If the wetland is a complex including isolated wetlands, apportion the l00 points according to area. For example if 10 ha of a l00 ha complex is isolated, the isolated portion receives the maximum proportional score of 10. The remainder of the wetland is then evaluated out of 90.

Step 1: Detennination of Maximum Score

_____	Wetland is located on one of the defined 5 large lakes or 5 major rivers (Go to Step 4)
_____	Wetland is entirely isolated (i.e. not part of a complex) (Go to Step 4)
X	All other wetland types (Go through Steps 2,3 and 4B)

Step 2: Determination of Upstream Detention Factor (DF)

(a)	Wetland area (ha)		3.97	
(b)	Total area (ha) of upstream detention areas (include the wetland itself)		185.26	***estimate***
(c)	Ratio of (a):(b)		0.02	
(d)	Upstream detention factor: (c) x 2 = (maximum allowable factor = 1)	0.0	0.04	

Step 3: Determination of Wetland Attenuation Factor (AF)

(a)	Wetland area (ha)		3.97	
(b)	Size of catchment basin (ha) upstream of wetland (include wetland itself in catchment area)		6367.76	***calculate***
(c)	Ratio of (a):(b)		0.00	
(d)	Wetland attenuation factor: (c) x 10 = (maximum allowable factor = 1)	0.0	0.01	

Step 4: Calculation of final score

(a)	Wetlands on large lakes or major rivers		0
(b)	Wetland entirely isolated		l00
(b)	All other wetlands --calculate as follows:		
(c	* Complex Formula - Isolated portion	100.00	
	Initial Score		100 *
	Upstream detention factor (DF) (Step 2)		0.04
	Wetland attenuation factor (AF) (Step 3)		0.01
	Final score: [(DF + AF)/2] x Initial score =		2.45
(c	* Final score:=	2	

*Unless wetland is a complex with isolated portions (see above).

Flood Attenuation Score (maximum l00 points) 2.0

3.2 WATER QUALITY IMPROVEMENT

3.2.1 SHORT TERM WATER QUALITY IMPROVEMENT

Step 1: **Determination of maximum initial score**

	Wetland on one of the 5 defined large lakes or 5 major rivers (Go to Step 5a)
X	All other wetlands (Go through Steps 2, 3, 4, and 5b)

Step 2: **Determination of watershed improvement factor (WIF)**

Calculation of WIF is based on the fractional area (FA) of each site type that makes up the total area of the wetland.

(FA= area of site type/total area of wetland)	Fractional Area				
FA of isolated wetland	0.00	x	0.5	=	0.00
FA of riverine wetland	0.00	x	1	=	0.00
FA of palustrine wetland with no inflow		x	0.7	=	0.00
FA of palustrine wetland with inflows	1.00	x	1	=	1.00
FA of lacustrine on lake shoreline	0.00	x	0.2	=	0.00
FA of lacustrine at lake inflow or outflow		x	1	=	0.00
			Sub Total:		1.00
			Sum (WIF cannot exceed 1.0)		1.00

Step 3: Determination of catchment land use factor (LUF)
(Choose the first category that fits upstream landuse in the catchment.)

1)	1.0	Over 50% agricultural and/or urban	1.0
2)		Between 30 and 50% agricultural and/or urban	0.8
3)		Over 50% forested or other natural vegetation	0.6

LUF (maximum 1.0) 1.00

Step 4: Determination of pollutant uptake factor (PUT)

Calculation of PUT is based on the fractional area (FA) of each vegetation type that makes up the total area of the wetland. Base assessment on the dominant vegetation form for each community except where dead trees or shrubs dominate. In that case base assessment on the domininant live vegetation. (FA = area of vegetation type/total area of wetland)

	Fractional Area				
FA of wetland with live trees, shrubs, herbs or mosses (c,h,ts,ls,gc,m)	1.00	x	0.75	=	0.75
FA of wetland with emergent, submergent or floating vegetation (re,be,ne,su,f,ff)	0.00	x	1	=	0.00
FA of wetland with little or no vegetation (u)	0.00	x	0.5	=	0.00
			Subtotal:		0.75
Estimate FA from air photos or use default factor of "0.75"			**Sum (PUT cannot exceed 1.0)**		0.75

Step 5: **Calculation of final score**

(a)	Wetland on large lakes or major rivers	0
(b)	All other wetlands -calculate as follows	
	Initial score	60
	Water quality improvement factor (WQF)	1.00
	Land use factor (LUF)	1.00
	Pollutant uptake factor (PUT)	0.75
	Final score: 60 x WQF x LUF x PUT =	45.00

Short Term Water Quality Improvement Score (maximum 60 points) 45

3.2.2 LONG TERM NUTRIENT TRAP

Determine wetland type from aerial photos and soil type from OMAF soils maps.

Step 1:

	Wetland on large lakes or 5 major rivers	0 points
X	All other wetlands (proceed to Step 2)	

Step 2: Choose only one of the following settings that best describes the wetland being evaluated

1)		Wetland located in a river mouth	10 points
2)		Wetland is a bog, fen or swamp with more than 50% of the wetland being covered with organic soil	10
3)	3	Wetland is a bog, fen or swamp with less than 50% of the wetland being covered with organic soil	3
4)		Wetland is a marsh with more than 50% of the wetland covered with organic soil	3
5)		None of the above	0

Long Term Nutrient Trap Score (maximum 10 points) 3

3.2.3 GROUNDWATER DISCHARGE

The final score will be underestimated since some of the wetland characteristics cannot be scored

(Circle the characteristics that best describe the wetland being evaluated and then sum the scores. If the sum exceeds 30 points assign the maximum score of 30.)

Wetland Characteristics	Potential for Discharge					
	None to Little		Some		High	
Wetland type	1) Bog = 0		2) Swamp/Marsh = 2	2	3) Fen = 5	
Topography	1) Flat/rolling = 0	0	2) Hilly = 2		3) Steep = 5	
Wetland Area: Upslope Catchment Area	Large (>50%) = 0		Moderate (5-50%) = 2		Small <(5%) = 5	5
Lagg Development	1) None found = 0	0	2) Minor = 2		3) Extensive = 5	
Seeps	1) None = 0	0	2) = or < 3 seeps = 2		3) > 3 seeps = 5	
Surface marl deposits	1) None = 0	0	2) = or < 3 sites = 2		3) > 3 sites = 5	
Iron precipitates	1) None = 0	0	2) = or < 3 sites = 2		3) > 3 sites = 5	
Located within 1 km of a major aquifer	N/A = 0		N/A = 0		Yes = 10	
Totals		0		2		5

(Scores are cumulative maximum score 30 points)

Percentage of Catchment: 0.00

Groundwater Discharge Score (maximum 30 points) 7

3.3 CARBON SINK

Choose only one of the following

1)	Bog, fen or swamp with more than 50% coverage by organic soil		5 points
2)	Bog, fen or swamp with between 10 to 49% coverage by organic soil		2
3)	Marsh with more than 50% coverage by organic soil		3
4)	Wetlands not in one of the above categories	0	0

Carbon Sink Score (maximum 5 points) 0

Wetlands Manual

3.4 SHORELINE EROSION CONTROL

Step 1: ***Determine from ortho-aerial photography*** Score

0	Wetland entirely isolated or palustrine	0
	Any part of the Wetland riverine or lacustrine (proceed to Step 2)	

Step 2:

Choose the **one** characteristic that best describes the shoreline vegetation (see text for a definition of shoreline)

			Score
1)		Trees and shrubs	15
2)		Emergent vegetation	8
3)		Submergent vegetation	6
4)		Other shoreline vegetation	3
5)		No vegetation	0

Shoreline Erosion Control Score (maximum 15 points) 0

3.5 GROUND WATER RECHARGE

3.5.1 WETLAND SITE TYPE

Score

(a) Wetland > 50% lacustrine (by area) or located on one of the five major rivers 0

(b) Wetland not as above. Calculate final score as follows:
(FA= area of site type/total area of wetland)

	Fractional Area			
FA of isolated or palustrine wetland	1.00	x 50	=	50.0
FA of riverine wetland	0.00	x 20	=	0.0
FA of lacustrine wetland (wetland <50% lacustrine)	0.00	x 0	=	0.0
		Subtotal:		50.0

Ground Water Recharge Wetland Site Type Component Score (maximum 50 points) 50

3.5.2 WETLAND SOIL RECHARGE POTENTIAL

Determine from OMAF soils maps.

(Circle only **one** choice that best describes the hydrologic soil class of the area surrounding the wetland being evaluated.)

Dominant Wetland Type	1) Sand, loam, gravel, till		2) Clay or bedrock	
1) Lacustrine or on a major river	0		0	
2) Isolated	10		5	
3) Palustrine	7	7	4	
4) Riverine (not a major river)	5		2	
Totals		7		0

Ground Water Recharge Wetland Soil Recharge Potential Score (maximum 10 points) 7

4.0 SPECIAL FEATURES COMPONENT

4.1 RARITY

4.1.1 WETLANDS Ref Map

Site District 7E-5
Presence of wetland type (check one or more)

	Bog
	Fen
X	Swamp
	Marsh

Score for rarity within the landscape and rarity of the wetland type. Score for rarity of wetland type is cumulative (maximum 80 points) based on presence or absence.

Slte District	Score for Rarity within the Landscape	Score for Rarity of Wetland Type			
		Marsh	Swamp	Fen	Bog
6-1	60	40	0	80	80
6-2	60	40	0	80	80
6-3	40	10	0	40	80
6-4	60	40	0	80	80
6-5	20	40	0	80	80
6-6	40	20	0	80	80
6-7	60	10	0	80	80
6-8	20	20	0	80	80
6-9	0	20	0	80	80
6-10	20	0	20	80	80
6-11	0	30	0	80	80
6-12	0	30	0	60	80
6-13	60	10	0	80	80
6-14	40	20	0	40	80
6-15	40	0	0	80	80
7-1	60	0	60	80	80
7-2	60	0	0	80	80
7-3	**60**	**0**	**0**	80	80
7-4	80	0	0	80	80
7-5	60	20	0	80	80
7-6	80	30	0	80	80

Rarity within the Landscape Score (maximum 80 points) 60
Rarity of Wetland Type Score (maximum 80 points) 0

The updated scores for rarity in Site Region 7-5 are in the stages of review and still require official confirmation.(June 8, 2004)

4.1.2 SPECIES Spp Ref

4.1.2.1 BREEDING HABITAT FOR AN ENDANGERED OR THREATENED SPECIES

	Name of species		Source of information
1)			
2)			
3)			
4)			
5)			
	Total:	0	

Attach documentation.

Scoring:

For each species	250 points

(score is cumulative, no maximum score)

Breeding Habitat for Endangered or Threatened Species Score (no maximum) 0

4.1.2.2 TRADITIONAL MIGRATION OR FEEDING HABITAT FOR AN ENDANGERED OR THREATENED SPECIES

	Name of species		Source of information
1)			
2)			
3)			
4)			
5)			
	Total:	0	

Attach documentation.
Scoring:

For one species	150 points
For each additional species	75

(score is cumulative, no maximum score)

Traditional Habitat for Endangered Species Score (no maximum) 0

4.1.2.3 PROVINCIALLY SIGNIFICANT ANIMAL SPECIES Prov Ref

	Name of species	Source of information
1)		
2)		
3)		
4)		
5)		
6)		
7)		
8)		
9)		
10)		
11)		
12)		
13)		
14)		
15)		

Attach separate list if necessary; Attach documentation

Scoring:

Number of provincially significant animal species in the wetland:

1	species	=	50 points	14 species	=	154
2	species	=	80	15 species	=	156
3	species	=	95	16 species	=	158
4	species	=	105	17 species	=	160
5	species	=	115	18 species	=	162
6	species	=	125	19 species	=	164
7	species	=	130	20 species	=	166
8	species	=	135	21 species	=	168
9	species	=	140	22 species	=	170
10	species	=	143	23 species	=	172
11	species	=	146	24 species	=	174
12	species	=	149	25 species	=	176
13	species	=	152			

Add one point for every species past 25 (for example, 26 species = 177 points, 27 species = 178 points etc.)

(no maximum score)

Provincially Significant Animal Species Score (no maximum)

4.1.2.4 PROVINCIALLY SIGNIFICANT PLANT SPECIES

	(Scientific names must be recorded) Common Name	Scientific Name	Source of information
1)		#N/A	
2)		#N/A	
3)		#N/A	
4)		#N/A	
5)		#N/A	
6)		#N/A	
7)		#N/A	
8)		#N/A	
9)		#N/A	
10)		#N/A	
11)		#N/A	
12)		#N/A	
13)		#N/A	
14)		#N/A	
15)		#N/A	

Attach separate list if necessary; Attach documentation

Scoring:

Number of provincially significant plant species in the wetland:

1 species	=	50 points	14 species	=	154
2 species	=	80	15 species	=	156
3 species	=	95	16 species	=	158
4 species	=	105	17 species	=	160
5 species	=	115	18 species	=	162
6 species	=	125	19 species	=	164
7 species	=	130	20 species	=	166
8 species	=	135	21 species	=	168
9 species	=	140	22 species	=	170
10 species	=	143	23 species	=	172
11 species	=	146	24 species	=	174
12 species	=	149	25 species	=	176
13 species	=	152			

Add one point for every species past 25 (for example, 26 species = 177 points, 27 species = 178 points etc.)

Provincially Significant Plant Species Score (no maximum)

4.1.2.5 REGIONALLY SIGNIFICANT SPECIES (SITE REGION) Spp Ref

Scientific names must be recorded for plant species. **Lists of significant species must be approved by MNR.**

SIGNIFICANT IN SITE REGION:

.

	Common Name	Scientific Name	Source of information
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			
12)			
13)			
14)			
15)			

Attach separate list if necessary .Attach documentation.

Scoring:

No. of species significant in Site Region

1 species	=	20	6 species	=	55
2 species	=	30	7 species	=	58
3 species	=	40	8 species	=	61
4 species	=	45	9 species	=	64
5 species	=	50	10 species	=	67

Add one point for every species past 10. (no maximum score)

Regionally Significant Species Score (Site Region)(no maximum)

Additional Species					
Scienctific Name	Common Name	S Rank	G Rank	Wet CoE	Comments
Plants					
Trees					
Acer negundo	Manitoba Maple	S5	G5	-2	Field Data: Rdrabick
Acer rubrum	Red Maple	S5	G5	0	Field Data: Rdrabick
Acer saccharinum	Silver Maple	S5	G5	-3	Field Data: Rdrabick
Fraxinus pennsylvanica	Red Ash	S5	G5	-3	Field Data: Rdrabick
Juglans nigra	Black Walnut	S4	G5	3	Field Data: Rdrabick
Populus deltoides ssp. deltoides	Eastern Cottonwood	S5	G5	-1	Field Data: Rdrabick
Prunus serotina	Black Cherry	S5	G5	3	Field Data: Rdrabick
Salix nigra	Black Willow	S4?	G5	-5	Field Data: Rdrabick
Ulmus americana	White Elm	S5	G5?	-2	Field Data: Rdrabick
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Shrubs					
Cornus amomum ssp. obliqua	Silky Dogwood	S5	G5	-4	Field Data: Rdrabick
Cornus foemina ssp. racemosa	Grey Dogwood	S5	G5	-2	Field Data: Rdrabick
Cornus stolonifera	Red-osier Dogwood	S5	G5	-3	Field Data: Rdrabick
Rhamnus frangula	Glossy Buckthorn	SE5	G?	-1	Field Data: Rdrabick
Rhus radicans ssp. rydbergii	Western Poison-ivy	S5	G5	0	Field Data: Rdrabick
Rubus occidentalis	Black Raspberry	S5	G5	5	Field Data: Rdrabick
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Ferns					
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Sedge					
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Rush					
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Vine					
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Woody Vines					
Vitis riparia	Riverbank Grape	S5	G5	-2	Field Data: Rdrabick
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Graminoid					
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Herb					
Bidens frondosa	Devil's Beggar-ticks	S5	G5	-3	Field Data: Rdrabick
Circaea lutetiana ssp. canadensis	Canada Enchanter's Nightshade	S5	G5	3	Field Data: Rdrabick
Impatiens capensis	Spotted touch-me-not	S5	G5	-3	Field Data: Rdrabick
Pilea pumila	Common Clearweed	S5	G5	-3	Field Data: Rdrabick
Polygonum virginianum	Jumpseed	S4	G5	0	Field Data: Rdrabick
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Amphibians					
Bufo americanus	American Toad	S5	G5	0	MNR Herp Data, found adjacent to wetland
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Mammals					
Vulpes vulpes	Red Fox	S5	G5	0	Niagara Trapping Data
Didelphis virginiana	Virginia Opossum	S4	G5	0	Niagara Trapping Data
Procyon lotor	Raccoon	S5	G5	0	Niagara Trapping Data
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Birds					
Turdus migratorius	American Robin	S5B,SZN	G5	0	Breeding Bird Data
Hirundo rustica	Barn Swallow	S4B	G5	0	Breeding Bird Data,adjacent to site
Quiscalus quiscula	Common Grackle	S5B,SZN	G5	0	Breeding Bird Data
Tyrannus tyrannus	Eastern Kingbird	S5B,SZN	G5	0	Breeding Bird Data
Sturnus vulgaris	European Starling	SE	G5	0	Breeding Bird Data
Charadrius vociferus	Killdeer	S5B,SZN	G5	0	Breeding Bird Data
Zenaida macroura	Mourning Dove	S5B,SZN	G5	0	Breeding Bird Data
Agelaius phoeniceus	Red-winged blackbird	S5B,SZN	G5	0	Breeding Bird Data
Larus delawarensis	Ring-billed gull	S5B,SZN	G5	0	Breeding Bird Data

#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Reptiles					
Chrysemys picta marginata	Midland Painted Turtle	S5	G5T5	0	MNR Herp Data, both species found adjacent to wetland
Trachemys scripta	Pond Slider (Red eared)	SE1	G5	0	MNR Herp Data
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Fish					
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
Lepedoptra					
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	
#N/A		#N/A	#N/A	#N/A	

4.2.1.6 LOCALLY SIGNIFICANT SPECIES (SITE DISTRICT)

Scientific names must be recorded for plant species. **Lists of significant species must be approved by MNR.**

	Common Name	Scientific Name	Source of information
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

Attach separate list if necessary .Attach documentation.

Scoring:

No. of species significant in Site District

1 species	=	10	6 species	=	41
2 species	=	17	7 species	=	43
3 species	=	24	8 species	=	45
4 species	=	31	9 species	=	47
5 species	=	38	10 species	=	49

For each significant species over 10 in the wetland, add 1 point.

Locally Significant Species Score (Site District) (no maximum)

4.2 SIGNIFICANT FEATURES AND/OR FISH & WILDLIFE HABITAT

4.2.1 NESTING OF COLONIAL WATERBIRDS

Status	Name of species	Source of Information	Score	
1) Currently nesting			50	
2) Known to have nested within past 5 years			25	
3) Active feeding area (Do not include feeding by great blue herons)			15	
4) None known			0	0

Consult the Ontario Heronry database at Bird Studies Canada. Subtotal: 0

Attach documentation (nest locations etc., if known)

Score highest applicable category only; maximum score 50 points.

Score for Nesting Colonial Waterbirds (maximum 50 points) 0

4.2.2. WINTER COVER FOR WILDLIFE

Score "locally significant" if trees & shrubs are present, also consult District deer yard data.

(Check only highest level of significance) **(one only)**		Score
1)	Provincially significant	l00
2)	Significant in Site Region	50
3)	Significant in Site District	25
3) 10	Locally significant	10
4)	Little or poor winter cover present	0

Source of information: Niagara Area Biologist: A.Yagi: 2011

Winter Cover for Wildlife Score (maximum l00 points) 10

4.2.3 WATERFOWL STAGING AND/OR MOULTING

(Check only highest level of significance for both staging and moulting; score is cumulative across columns, maximum score 15

		Staging	Score (one only)	Moulting	Score (one only)
1)	Nationally significant		150		150
2)	Provincially significant		100		l00
3)	Regionally significant		50		50
4)	Known to occur		10		10
5)	Not possible		0		0
6)	Unknown	0	0	0	0
	Total:	0		0	
	Subtotal:		0		

Source of information: Niagara Area Biologist: A.Yagi: 2011

Waterfowl Moulting and Staging Score (maximum 150 points) 0

4.2.4 WATERFOWL BREEDING

		(Check only highest level of significance)	Score
1)		Provincially significant	l00
2)		Regionally significant	50
3)	10	Habitat suitable	10
4)		Habitat not suitable	0

Source of information: Niagara Area Biologist: A.Yagi: 2011

Waterfowl Breeding Score (maximum lOO points) 10

4.2.5 MIGRATOR PASSERINE, SHOREBIRD OR RAPTOR STOPOVER AREA

(check highest applicable category)

1)		Provincially significant	l00
2)		Significant in Site Region	50
3)		Significant in Site District	10
4)	0	Not significant	0

Source of information: Niagara Area Biologist: A.Yagi: 2011

Passerine, Shorebird or Raptor Stopover Score (maximum 100 points) 0

4.2.6 FISH HABITAT

Consult District Fisheries files. If fish are present in the wetland, score 15 or 25 points depending on the size of the fish habitat present.

4.2.6. Spawning and Nursery Habitat

Table 5. Area Factors for Low Marsh, High Marsh, and Swamp Communities.

No. of ha of Fish Habitat	Area Factor
< 0.5 ha	0.1
0.5- 4.9	0.2
5.0- 9.9	0.4
10.0- 14.9	0.6
15.0 -19.9	0.8
20.0+ ha	1.0

Step 1:

0 Fish habitat is not present within the wetland (Score = 0)

_____ Fish habitat is present within the wetland (Go to Step 2)

Step 2: Choose only one option

1) _____ Significance of the spawning and nursery habitat within the wetland is known (Go to Step 3)

2) _____ Significance of the spawning and nursery habitat within the wetland is not known (Go through Steps 4, 5, 6 and 7)

Step 3: Select the highest appropriate category below attach documentation:

1)		Significant in Site Region	l00 points
2)		Significant in Site District	50
3)		Locally Significant Habitat (5.0+ ha)	25
4)		Locally Significant Habitat (<5.0 ha)	15

Score for Spawning and Nursery Habitat (maximum score 100 points) 0

Step 4: **Proceed to Steps 4 to 7 only if Step 3 was not answered.**

(**Low Marsh**: marsh area from the existing water line out to the outer boundary of the wetland)

X Low marsh not present (Continue to Step 5)
_____ Low marsh present (Score as follows)

Scoring for Presence of Key Vegetation Groups

Scoring is based on the one most clearly dominant plant species of the dominant form in each Low Marsh vegetation community. Check the appropriate Vegetation Group (see Appendix 16 Table 16-2) for each Low Marsh community. Sum the areas of the communities assigned to each Vegetation Group and multiply by the appropriate size factor from Table 5.

Vegetation Group Number	Vegetation Group Name	Present as a Dominant Form (check)	Total Area (ha)	Area Factor (see Table 5)	Score	Final Score (area factor x score)
1	Tallgrass				6 pts	0.0
2	Shortgrass-Sedge				11	0.0
3	Cattail-Bulrush-Burreed				5	0.0
4	Arrowhead-Pickerelweed				5	0.0
5	Duckweed				2	0.0
6	Smartweed-Waterwillow				6	0.0
7	Waterlily-Lotus				11	0.0
8	Waterweed-Watercress				9	0.0
9	Ribbongrass				10	0.0
10	Coontail-Naiad-Watermilfoil				13	0.0
11	Narrowleaf Pondweed				5	0.0
12	Broadleaf Pondweed				8	0.0
Sub Total Score (maximum 75 points)						0.0
Total Score (maximum 75 points)						0.0

Step 5: (**High Marsh**: area from the water line to the inland boundary of marsh wetland type. This is essentially what is commonly referred to as a wet meadow, in that there is insufficient standing water to provide fisheries habitat except during flood or high water conditions.)

X High marsh not present (Continue to Step 6)
_____ High marsh present (Score as follows)

Scoring for Presence of Key Vegetation Groups

Scoring is based on the one most clearly dominant plant species of the dominant form in each High 1Marsh vegetation community. Check the appropriate Vegetation Group (see Appendix 16 Table 16-2) for each High Marsh community. Sum the areas of the communities assigned to each Vegetation Group and multiply by the appropriate size factor from Table 5.

Vegetation Group Number	Vegetation Group Name	Present as a Dominant Form (check)	Total Area (ha)	Area Factor (see Table 5)	Score	Final Score (area factor x score)
1	Tallgrass				6 pts	0.0
2	Shortgrass-Sedge				11	0.0
3	Cattail-Bulrush-Burreed				5	0.0
4	Arrowhead-Pickerelweed				5	0.0
Sub Total Score (maximum 25 points)						0.0
Total Score (maximum 25 points)						0.0

Step 6: (**Swamp**: Swamp communities containing fish habitat,either seasonally or permanently. Determine the total area of seasonally flooded swamps and permanently flooded swamps containing fish habitat.)

X Swamp containing fish habitat not present (Continue to Step 7)
_____ Swamp containing fish habitat present (Score as follows)

Swamp containing fish Habitat	Present (check)	Total area (ha)	Area Factor (see Table 5)	Score	TOTAL SCORE (factor x score)
Seasonally flooded				10	0.0
Permanently flooded				10	0.0
Sub SCORE (maximum 20 points)					0.0
SCORE (maximum 20 points)					0.0

Step 7: Calculation of final score

Score for Spawning and Nursery Habitat (Low Marsh) (maximum 75) = 0.0

Score for Spawning and Nursery Habitat (High Marsh) (maximum 25) = 0.0

Score for Swamp Containing Fish Habitat (maximum 20) = 0.0

Subtotal: 0.0

Sum (maximum score 100 points) = 0.0

4.2.6.2 Migration and Staging Habitat ***Score only if information on fish migration and staging exists, e.g. migration of northern pike through a wetland to access spawning areas.***

Step 1:

1) **0** Staging or Migration Habitat is not present in the wetland (Score = 0)

2) _____ Staging or Migration Habitat is present in the wetland significance of the habitat is known (Go to Step 2)

3) _____ Staging or Migration Habitat is present in the wetland significance of the habitat is not known (Go to Step 3)

NOTE: Only one of Step 2 or Step 3 is to be scored.

Step 2: Select the highest appropriate category below, attach documentation:

		Score
1)	Significant in Site Region	25 points
2)	Significant in Site District	15
3)	Locally Significant	10
4)	Fish staging and/or migration habitat present,but not as above	5

Score for Fish Migration and Staging Habitat (maximum score 25 points) 0

Step 3: Select the highest appropriate category below based on presence of the designated site type (does not have to be dominant). See Section 1.1.3. Note name of river for 2) and 3).

		Score
1)	Wetland is riverine at rivermouth or lacustrine at rivermouth	25 points
2)	Wetland is riverine,within 0.75 km of rivermouth	15
3)	Wetland is lacustrine,within 0.75 km of rivermouth	10
4)	Fish staging and/or migration habitat present, but not as above	5

Score for Staging and Migration Habitat (maximum score 25 points) 0

4.3 ECOSYSTEM AGE

(Fractional Area = area of wetland/total wetland area)

	Fractional Area				Scoring
Bog	0.00	x	25	=	0.0
Fen, treed to open on deep soils floating mats or marl		x	20	=	0.0
Fen, on limestone rock		x	5	=	0.0
Swamp	1.00	x	3	=	3.0
Marsh	0.00	x	0	=	0.0
		Sub Total:			3.0

Ecosystem Age Score (maximum 25 points) 3.0

4.4 GREAT LAKES COASTAL WETLANDS

Score for coastal (see text for definition) wetlands only

Choose one only

0	wetland < 10 ha	=	0 points
	wetland 10- 50 ha	=	25
	wetland 51 -lOO ha	=	50
	wetland > 100 ha	=	75

Great Lakes Coastal Wetlands Score (maximum 75 points) 0

____ The wetland is not within the Coastal zone for either the Great Lakes or associated major rivers and as such will not be scored within this section.

5.0 EXTRA INFORMATION

5.1 PURPLE LOOSESTRIFE

____ Absent/Not seen

X Present

(a) One location in wetland ____
Two to many locations X

Abundance code
(b) (1 < 20 stems ____
(2 20-99 stems ____
(3 100-999 stems ____
(4 >1000 stems ____

5.2 SEASONALLY FLOODED AREAS

Check one or more

Ephemeral	(less than 2 weeks)	X
Temporal	(2 weeks to 1 month)	X
Seasonal	(1 to 3 months)	____
Semi-permanent	(>3 months)	____
No seasonal flooding		____

5.3 SPECIES OF SPECIAL SIGNIFICANCE

5.3.1 Osprey

Present and nesting	____
Known to have nested in last 5 yr	____
Feeding area for osprey	____
Not as above	X

5.3.2 Common Loon

Nesting in wetland	____
Feeding at edge of wetland	____
Observed or heard on lake or river adjoining the wetland	____
Not as above	X

WETLAND EVALUATION SCORING RECORD

WETLAND NAME AND/OR NUMBER: Welland Canal Seaway Wetland

1.0 BIOLOGICAL COMPONENT

1.1 PRODUCTIVITY

1.1.1	Growing Degree-Days/Soils	26.0	
1.1.2	Wetland Type	8.0	
1.1.3	Site Type	2.0	
	Total for Productivity		36

1.2 BIODIVERSITY

1.2.1	Number of Wetland Types	9.0	
1.2.2	Vegetation Communities (maxixmum 45)	1.5	
1.2.3	Diversity of Surrounding Habitat (maximum 7)	5.0	
1.2.4	Proximinty to Other Wetlands	8.0	
1.2.5	Interspersion	9.0	
1.2.6	Open Water Type	14.0	
	Total for Biodiversity		47
	Sub Total for Biodiversity	47	

1.3 SIZE (Biological Component) 5

Sub Total: 88

TOTAL FOR BIOLOGICAL COMPONENT (not to exceed 250) 88

2.0 SOCIAL COMPONENT

2.1 ECONOMICALLY VALUABLE PRODUCTS

2.1.1	Wood Products	0
2.1.2	Wild Rice	0
2.1.3	Commercial Fish	0
2.1.4	Bullfrogs	0
2.1.5	Snapping Turtles	0
2.1.6	Furbearers	12

Total for Economically Valuable Products: 12

2.2 RECREATIONAl ACTIVITIES (maximum 80): 8

2.3 LANDSCAPE AESTHETICS

2.3.1	Distinctness	0
2.3.2	Absence of Human Disturbance	2

Total for Landscape Aesthetics: 2

2.4 EDUCATION AND PUBLIC AWARENESS

2.4.1	Educational Uses	0
2.4.2	Facilities and Programs	2
2.4.3	Research and Studies	0

Total for Education and Public Awareness: 2

2.5 PROXIMITY TO AREAS OF HUMAN SETTLEMENT: 40

2.6 OWNERSH1P: 4

Subtotal for Social Component: 60.0

2.7 SIZE (Social Component): 4

2.8 ABORIGINAL AND CULTURAL VALUES: 0

Sub Total: 72

TOTAL FOR SOCIAL COMPONENT (not to exceed 250): 72

3.0 HYDROLOGICAL COMPONENT

3.1 FLOOD ATTENUATION		2
3.2 WATER QUALITY IMPROVEMENT		
3.2.1 Short Term Improvement	45.0	
3.2.2 Long Term Improvement	3.0	
3.2.3 Groundwater Discharge (maximum 30)	7.0	
Total for Water Quality Improvement		55
3.3 CARBON SINK		0
3.4 SHORELINE EROSION CONTROL		0
3.5 GROUNDWATER RECHARGE		
3.5.1 Site Type	50.00	
3.5.2 Soils	7.0	
Total for Groundwater Recharge		57
Sub Total:		114
TOTAL FOR HYDROLOGICAL COMPONENT (not to exceed 250)		114

4.0 SPECIAL FEATURES

4.1 RARITY

4.1.1 Wetlands		
4.1.1.1 Rarity within the Landscape	60.0	
4.1.1.2 Rarirty of Wetland Type (maximum 80)	0.0	
Total for Wetland Rarity		60
4.1.2 Species		
4.1.2.1 Endangered or Threatened Species Breeding	0.0	
4.1.2.2 Traditional Use by Endangered or Threatened Species	0.0	
4.1.2.3 Provincially Significant Animals	0.0	
4.1.2.4 Provincially Significant Plants	0.0	
4.1.2.5 Regionally Significant Species	0.0	
4.1.2.6 Locally Significant Species	0.0	
Total for Species Rarity		0

4.2 SIGNIFICANT FEATURES OR HABITAT

4.2.1 Colonial Waterbirds	0.0	
4.2.2 Winter Cover for Wildlife	10.0	
4.2.3 Waterfowl Staging and Moulting	0.0	
4.2.4 Waterfowl Breeding	10.0	
4.2.5 Migratory Passerine, Shorebird or Raptor Stopover	0.0	
4.2.6 Fish Habitat	0.0	
Total for Significant Features and Habitat		20

4.3 ECOSYSTEM AGE	3
4.4 GREAT LAKES COASTAL WETLANDS	0
Sub Total:	83
TOTAL FOR SPECIAL FEATURES (maximum 250)	83

Southern Ontario Wetland Evaluation, Score Summary — March 1993

Wetlands Manual

SUMMARY OF EVALUATION RESULT

Wetland	Welland Canal Seaway Wetland
TOTAL FOR 1.0 BIOLOGICAL COMPONENT	88
TOTAL FOR 2.0 SOCIAL COMPONENT	72
TOTAL FOR 3.0 HYDROLOGICAL COMPONENT	114
TOTAL FOR 4.0 SPECIAL FEATURES COMPONENT	83
WETLAND TOTAL	357

INVESTIGATORS
R.Drabick, A.Yagi: 2011
0
0
0
0

AFFILIATION
OMNR
0
0
0
0

DATE: January 0, 1900

Ministry of Natural Resources
Guelph District
Vineland Office

Welland Canal Seaway
Wetland

Polygon Identification

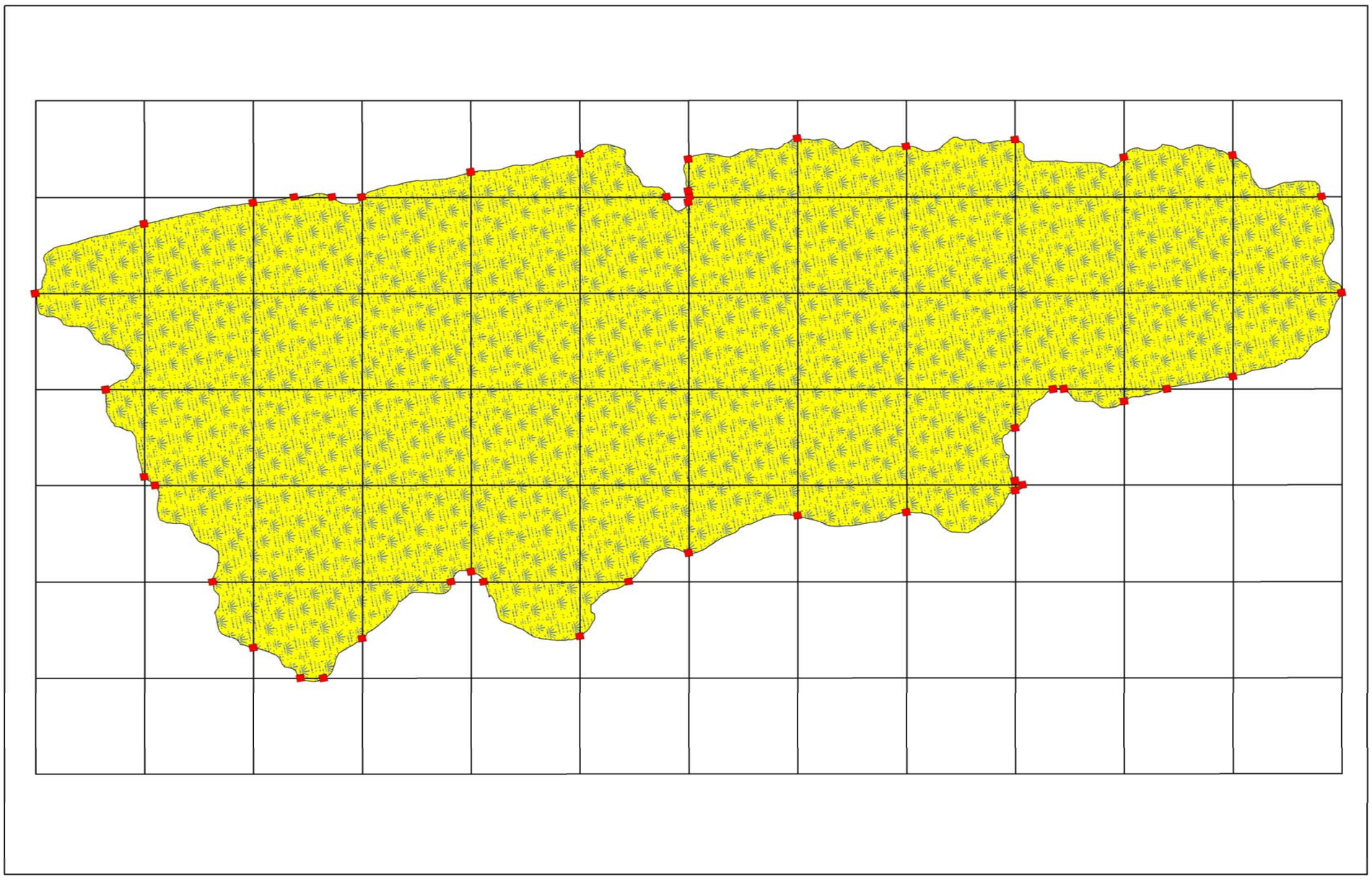
August 22, 2011

Guelph District/Vineland Office
Wetland Legend

- Welland_Canal_Seaway
- Welland Canal Seaway Inters (48)
- Welland Canal Seaway Grid

1:1,073

Ontario



Horizontal:													0
Vertical:													0
													0

Ministry of Natural Resources
Guelph District
Vineland Office

Welland Canal Seaway
Wetland

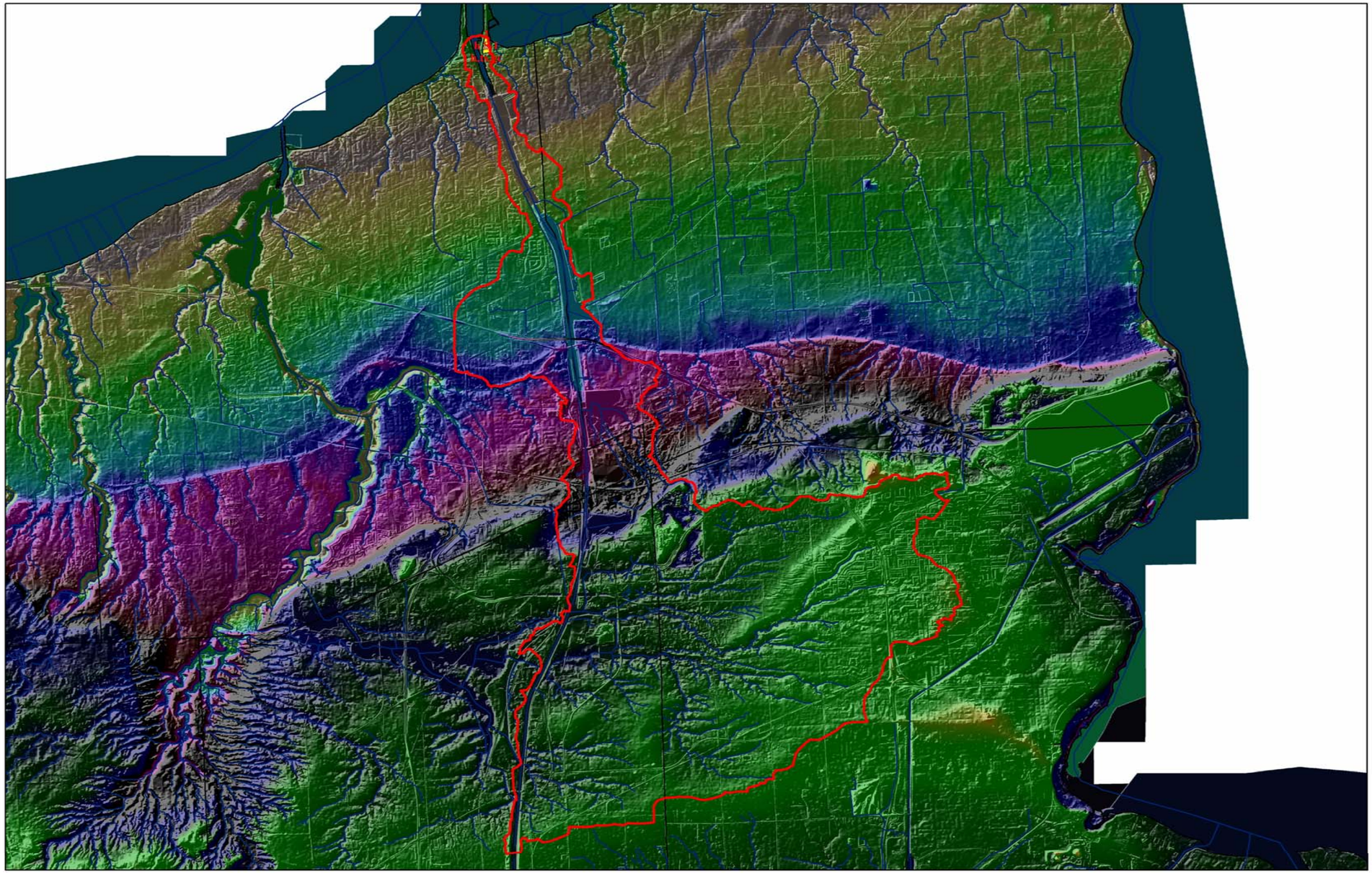
Catchment: 6367.76 ha

August 22, 2011

Guelph District/Vineland Office
Wetland Legend

- Welland_Canal_Seaway
- Welland C SeaW Catchm2011
- Waterflow
- Municipal Lower Tier Boundary

1:74,105




Ministry of Natural Resources
Guelph District
Vineland Office
Welland Canal Seaway
Wetland
Polygon Identification
August 22, 2011
Guelph District/Vineland Office
Wetland Legend
Welland_Canal_Seaway
Waterflow
Niagara_Woodlots
Transportation Network
Municipal Lower Tier Boundary
1:2,446
N
W
E
S
Ontario
Broadway
Seaway Haulage
Welland Canals
Lakeside
Stepney
Bromley
Runcorn
Brigantine

Ministry of Natural Resources
Guelph District
Vineland Office

Welland Canal Seaway
Welland

Polygon Identification

August 22, 2011

Guelph District/Vineland Office
Wetland Legend
- Welland_Canal_Seaway
- Waterflow
- Transportation Network
- Municipal Lower Tier Boundary

1:2,446

N
W E
S

Data Summery Form

Code:
Wetland Name:

WETLAND UNIT #	DOMINATE FORM	WETLAND TYPE	COMMUNITY CODE	COMMUNITY SUB_CODE	AREA (ha)	SITE TYPE	SOIL	FORMS	# OF FORMS	% OPEN WATER	ha OPEN WATER	FISH HABITAT (LM / HM)	Dominate Species	Additional Species	COMMENTS	Soil Texture	Depth to Mottles	Depth to Gleying	Moisture Regime	Drainage	Field Map Code
1	h	Swamp	1		3.97	Palustrine	clay/loam	h,ts,gc	3		-		h: Green Ash	h: Ms,Wb,Ctwd,Ew,Mm,Wisp; ts: ,sdwd,Ebuth,rbgrpe; gc:poison ivy, violet spp							
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
											-										
					3.97						-										

Appendix 5 Qualifications of the Assessors

CV – Andrew Dunbrack

CV – Bruce Harper

ANDREW DUNBRACK P.Eng., QP$_{ESA}$

Mr. Andrew Dunbrack joined Englobe Corp. (Englobe) in January 2013 after working as a Project Engineer for Conestoga-Rovers & Associates Limited, in Waterloo, Ontario. Mr. Dunbrack graduated from the University of Guelph with a Bachelors of Science in Environmental Engineering. Mr. Dunbrack is a member of Englobe's Environmental Services Group where he specializes in Phase I (One) and II (Two) Environmental Site Assessments, as well as site remediation and site restoration in support of property transactions, environmental due diligence, and/or regulatory requirements.

As an Environmental Engineer and Project Manager, Mr. Dunbrack is responsible for various components of project work including Phase I (One) and II (Two) Environmental Site Assessments (ESAs), decommissioning of underground storage tanks and remediation projects, and prepares technical proposals, develop work plans, schedule and execute fieldwork for various environmental-related projects. For Phase 1 ESAs, Mr. Dunbrack acts as a Project Manager and Site Assessor for industrial, commercial, agricultural, and residential site assessments, and has specific responsibilities include project organization, research, site inspections and completion of reports.

For Phase II ESAs, Mr. Dunbrack acts as a Project manager, coordinator for soil and groundwater investigations for industrial, commercial, agricultural, and residential properties, plans borehole and monitoring well layouts, supervises drilling and/or test-pitting, and obtains soil and groundwater samples for chemical analyses. The Typical Reference Materials used for each project include: Ontario Regulation 153/04 as amended, Records of Site Condition – Part XV.1 of the EPA; Environmental Mangement Protocol for Fuel Handling Sites in Ontario, TSSA EMP-2012; Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario (MOEE, 1996); CSA Phase I Environmental Site Assessment Standard Z768-01; CSA Phase II Environmental Site Assessment Standard Z769-00; Guide for Completing Phase One ESAs under Ontario Regulation 153/04, June 2011; Guide for Completing Phase Two ESAs under Ontario Regulation 153/04, June 2011; and, 1990 Ontario Regulation 347 – Waste Management.

YEARS OF EXPERIENCE

12 years

PROFESSION

Environmental Engineer

AREA OF EXPERTISE

Environmental Site Assessments and Site Characterization, Site Remediation and Decommissioning, Remediation Project Contract and Tendering, Record of Site Conditions

EDUCATION

2006 Bachelors of Science (B.Sc.) in Environmental Engineering, University of Guelph, Guelph, Ontario

PROFESSIONAL DEVELOPMENT

2017 GO / METROLINX Contractor Orientation

2017 HAZWOPER Safety Training

2017 WHMIS Training

2017 IHSA Asbestos Work in Construction Hazard Awareness Training

2013 Petroleum Oriented Safety Training

PROFESSIONAL ASSOCIATIONS

Professional Engineers Ontario (PEO), License Number 100156622, since 2010

Qualified Person since 2015 for conducting ESAs (QPESA) under Ontario Regulation 153/04, as amended

PROFESSIONAL EXPERIENCE

ENVIRONMENTAL SITE ASSESSMENTS

The Torgan Group, Source Water Protection Contamination Study, 87 Regina Street South, Waterloo, Ontario (2017)

Project Engineer - The proposed redevelopment of a property located in the uptown core of Waterloo. In consultation with the City of Waterloo, a Source Water Protection Contamination Study was completed to identify any potentially contaminating activities on the Site and surrounding properties that may result in areas of potential environmental concerns. Any areas of potential environmental concern were investigated with a subsurface investigation to evaluate the potential impact to the local municipal water supply.

Hunt Club Valley Inc., Phase Two ESA and Remedial Activities, Hunt Club / Arisscraft Lands, Speedsville Road, Cambridge, Ontario (2015 to present)

Project Engineer - Large development project (approximately 122 hectares) located between Maple Grove Road and the Speed River in Cambridge, Ontario. The proposed development will comprise of residential and mixed use properties (a school lot, stormwater management facilities, and approximately 29 hectares of open space). The project was designed to facilitate eventual filing of one or more Records of Site Condition with the Ministry of the Environment and Climate Change.

Metrolinx, Phase I / II ESAs and Subsurface Investigations, Various Sites, Ontario (2014 to present)

Project Manager / Engineer - Responsibilities include overall project management, liaison with the client and contractors, review and approval of contractors work plans and schedule, direct project team and field staff. Projects were generally completed for the potential purchase and re-development of properties in southern Ontario. The properties ranged in land uses (agricultural, residential, commercial and industrial).

Canadian Tire Real Estate Limited, Phase I/II ESAs and Geotechnical Investigation, 1 Mount Forest Drive, Mount Forest, Ontario (2015)

Site Assessor / Project Manager - Responsible for the preparation of Phase I and II ESA reports. Property was vacant land, proposed to be developed for commercial purposes. The environmental reports were completed to support the potential purchase and development of the property.

Erb Enterprises Inc., Phase I and II ESAs, 3025 Sandhills Drive, Wilmot, Ontario (2015)

Site Assessor / Project Manager - Responsible for the preparation of Phase I and II ESA reports. Property is a transport truck and trailer service / repair facility. The Phase I and II ESAs were conducted prior to the potential purchase of the property.

Abbotsford Homes Limited, Phase I and II ESAs, 310 Limeridge Road West Hamilton, Ontario (2015)

Site Assessor / Project Manager - Responsible for the preparation of Phase I and II ESA reports. Property was formerly utilized as a retail fuel outlet and grocery store. The Phase II ESA involved the drilling and installation of bedrock monitoring wells.

Toronto Waterfront, Phase I ESA, 3 Leslie Street, Toronto, Ontario (2015)

Site Assessor / Project Engineer - Responsible for the preparation of a Phase I ESA report. The property was lake infilled and has been proposed to be utilized for parkland use (trails).

See-Me Auto Leasing Ltd., Phase I ESA, 1201 Victoria Street North, Kitchener, Ontario (2015)

Site Assessor / Project Manager - Responsible for the preparation of a Phase I ESA report. The property was formerly used as a bulk fuel outlet and is currently utilized for the sale of automobiles. The report was prepared for refinancing purposes.

West-Ag Resources Inc., Phase One / Two ESAs and Record of Site Condition, Baden, Ontario (2014-2015)

Project Manager / Site Assessor - The Phase One and Two ESAs were completed in accordance with Ontario Regulation 153/04, as amended. The work was completed for the purposes of the filing of a Record of Site Condition with the Ministry of the Environment and Climate Change. The property was formerly utilized a feed mill storage facility.

Barkley Auction Services, Environmental Investigation, Retail Fuel Outlet, 1712 Central Street, Claremont, Ontario (2014-2015)

Project Manager - Provided professional services as part of an environmental investigation conducted at a retail fuel outlet property. Project activities included a geophysical survey and a groundwater sampling and analysis programs. This report was required as part of a Technical Standards and Safety Authority order.

Waterous Holden Amey Hitchon LLP, Phase One / Two ESAs and Record of Site Conditions, 426 and 428 Mount Pleasant Road, Brant County, Ontario (2013-2015)

Project Manager - The Phase One and Two ESAs were completed in accordance with Ontario Regulation 153/04, as amended. The work was completed for the purposes of the filing of two Records of Site Conditions with the Ministry of the Environment and Climate Change. The property was formerly utilized as an abattoir facility and has been proposed to be re-developed for residential purposes.

WalterFedy, Renison College 2014 Expansion, Waterloo, Ontario (2014)

Project Engineer - Provided professional services for Test Pit Soil Sampling and Analysis Program during construction activities, approximately 5,000 cubic metres of excess soils were generated, which required off-site disposal and/or reuse on-site, if appropriate. Englobe was retained to carry out geotechnical investigations, environmental investigation and construction materials testing for the Site. The addition was initially three storeys in height including a basement with potential for the addition of seven storeys at a later date.

Counsel Park Road Limited, Phase One ESA and Record of Site Conditions, 575 Park Road North, Brantford, Ontario (2014)

Project Manager - The Phase One ESA was completed in accordance with Ontario Regulation 153/04, as amended. The work was completed for the purposes of filing Record of Site Conditions to the Ministry of the Environment and Climate Change, in support of the proposed future residential land use of the property. Property was owned by two separate companies and formerly utilized for commercial purposes.

Country Park Shopping Centre Inc., Update Phase I ESA and Groundwater Sampling and Analysis, 1450 Block Line Road, Kitchener, Ontario (2014)

Site Assessor / Project Manager - Responsible for preparing an Update Phase I ESA and Groundwater Sampling and Analysis reports. Property was utilized for commercial purposes. The reports were prepared for refinancing purposes.

Delta Engineers, Architects & Land Surveyors, Phase I and II ESAs, Various Sites (2014)

Site Assessor / Project Manager - Responsible for preparing Phase I and II ESA reports. Properties were vacant properties, proposed to be developed for commercial purposes.

Altruck International, Update Phase I ESA and Groundwater Sampling and Analysis, 405 Laird Road, Guelph, Ontario (2014)

Site Assessor / Project Manager - Responsible for preparing an Update Phase I ESA and Groundwater Sampling and Analysis reports. Property was used as a transport truck repair and storage facility. The environmental reports were completed for the potential purchase of the property.

Bell Mobility, Phase I ESA and Subsurface Investigations, Proposed Telecommunications Towers, Various Sites, Ontario (2013-2014)

Project Manager - Responsible for performing Phase I ESAs in accordance to CSA Z768-01, and subsurface investigations included soil and groundwater sampling and analysis programs, for a number of properties across Ontario. The properties were for proposed telecommunication towers in Ontario.

Rogers Communications, Existing Telecommunications Towers, Various Sites, Ontario (2013)

Site Assessor / Project Manager - Responsible for performing Phase I ESAs in accordance to CSA Z768-01, for a number of properties across Ontario. The properties were existing telecommunication towers in Ontario.

Potspoon Development Inc., Phase I and II ESA, 2200 Eagle Street North, Cambridge, Ontario (2013)

Site Assessor / Project Manager - Responsible for the preparation of Phase I and II ESA reports. Property was used as an automotive dealership including a repair facility. The environmental reports were completed to support the potential sale of the property.

Dawsco Capital, Phase I ESA, 118 Yorkville Avenue, Toronto, Ontario (2013)

Site Assessor / Project Manager - Responsible for the completion of a Phase I ESA report of a ten-storey apartment / condominium building. The Phase I ESA was prepared for due diligence purposes in support of refinancing.

City of St. Thomas, Phase One and Two ESAs, 30 St. Catharine Street, St. Thomas, Ontario (2012)

Site Assessor / Project Manager - Responsible for the preparation of Phase One and Two ESA reports in accordance with Ontario Regulation 153/04. Property was owned by the City of St. Thomas and occupied by the Ontario Provincial Court and Police services.

SITE REMEDIATION AND ENVIRONMENTAL MANAGEMENT

Canadian Tire Real Estate Limited, Retail Fuel Outlet, Guelph, Ontario (2013 to 2016)

Project Manager / Engineer – Responsible for the annual groundwater sampling and analysis program at an active retail fuel outlet in Guelph, Ontario. Activities included the documentation of groundwater quality on/off site and any associated trends. Reports are prepared and issued to the City of Guelph and Technical Standards and Safety Authority for their review.

Public Works Government Services of Canada, 98 Manitoba Street, Bracebridge, Ontario (2014-2015)

Project Manager / Engineer – Responsible for the free product monitoring/recovery and groundwater sampling and analysis at a federally own property. Activities included groundwater sampling and free product removal using passive skimmers from existing monitoring wells and indoor air quality monitoring.

Canadian Tire Real Estate Limited, Excavation Monitoring and Soil Sampling, Various Sites in Ontario (2013-2015)

Project Manager / Engineer - Responsible for documenting the environmental conditions during the decommissioning of existing infrastructure including in-ground hoists, and waste oil and fuel underground storage tanks. Activities included the coordination of sub-contractors, field activities including oversight of the excavation, confirmatory soil sampling, excess soil disposal, and site restoration.

City of Brantford, Soil Sampling and Analysis Associated with the Removal of USTs, Various Sites (2015)

Project Manager - Documented the subsurface environmental soil quality during the decommissioning by removal of underground storage tanks. Activities included the liaison with sub-contractors, field oversight of the excavation activities, confirmatory soil sampling and reporting.

Skyline Retail REIT Real Estate Holdings Inc., Excavation Monitoring and Soil Sampling, 792 Broadway Street, Kincardine, Ontario (2014)

Project Manager / Engineer - Responsible for documenting the environmental conditions during the decommissioning by removal of four existing fuel underground storage tanks for the installation of two new fuel underground storage tanks. Activities included the liaison with sub-contractors, field oversight of the excavation, confirmatory soil sampling, excess soil disposal, and site restoration.

Confidential Client, Retail Fuel Outlet, 44 Hunter Street, Peterborough (2011)

Project Coordinator / Engineer – Responsible for the remedial activities and redevelopment of a former retail fuel outlet in Peterborough, Ontario. Activities included the removal of six fuel underground storage tanks, fuel impacted soils, and site restoration including the installation of two new fuel underground storage tanks.

Confidential Client, Former Landfill, Township of Norwich, Ontario (2010-2011)

Project Coordinator / Engineer - Responsible for the field oversight of the excavation, screening, disposal, and Site restoration of a 10,000 m3 landfill in the Township of Norwich. Liaison with contractors and the Ministry of the Environment and Climate Change to facilitate remedial strategies.

CAREER PATH

since August 2017	**Englobe Corp., Kitchener, Ontario** Team Leader, Environmental – Kitchener Operations
January – August 2017	**MTE, Kitchener, Ontario** Environmental Engineer, Project Manager
June 15, 2015 – December 2016	**Englobe Corp., Kitchener, Ontario** Environmental Engineer, Project Manager
June 2014 – June 2015	**LVM, a division of EnGlobe Corp., Kitchener, Ontario (formerly LVM inc.)** Environmental Engineer, Project Manager
2013 – 2014	**LVM inc., Kitchener, Ontario (formerly LVM-Naylor)** Environmental Engineer, Project Manager
2006 – 2012	**Conestoga-Rovers & Associates Limited** Environmental Engineer, Project Manager/Coordinator

BRUCE M. HARPER Ph.D., P,Eng.

Dr. Harper is a senior environmental engineer and risk assessment specialist with over 18 years of related experience. Dr. Harper has a doctoral degree in environmental engineering from the University of Guelph, where he conducted experimental and modelling research on the application of the soil vapour extraction in medium-fine textured media. Dr. Harper has a Masters of Engineering Science degree in biochemical engineering from Western University, where he conducted research on the biosorption of heavy metals. Following completion of his doctorate in 1999, Dr. Harper had been with several firms providing environmental consulting services to private and public sector clients. During his tenure, Dr. Harper has been involved in several environmental risk assessment projects across Ontario encompassing brownfields re-development and existing commercial, industrial and residential properties. He has managed numerous environmental investigation and contaminated site remediation projects. Dr. Harper's past project involvement has encompassed project management, data quality assessments, development and implementation of comprehensive sampling programs, geologic and hydrogeologic assessments, contaminant fate and transport modelling, human health risk assessments, risk management plans, health and safety and soil and groundwater management plans, and Record of Site Condition filings.

YEARS OF EXPERIENCE

18 years

PROFESSION

Senior Environmental Engineer

AREA OF EXPERTISE

Environmental Site Assessments, Risk Assessment, Risk Management, Site Remediation, Contaminant Fate and Transport

EDUCATION

1999 Ph.D., Environmental Engineering, University of Guelph, Guelph, ON

1993 M.E.Sc., Chemical Engineering, University of Western Ontario, London, ON

1983 B.Sc.E., Chemical Engineering, University of New Brunswick, New Brunswick

PROFESSIONAL DEVELOPMENT

2001 40-hour OSHA Personal Protection and Safety Training

1999 Environmental Regulations and Management, Education Program Innovation Centre, Mississauga, ON

PROFESSIONAL ASSOCIATIONS

Professional Engineers Ontario Licence Number 90465196 (September 2000)

LANGUAGES

English

PROFESSIONAL EXPERIENCE

RISK ASSESSMENT

Mercedes Corporation, Phase One and Two Environmental Site Assessments, 10 Front Street, St. Jacobs, Ontario, 2014 to 2017

Senior risk assessor and environmental engineer for residential re-development of existing riverfront commercial and environmentally sensitive site. Specific activities included project management, oversight of Phase One and Two environment assessments, development and implementation of comprehensive sampling programs, geologic and hydrogeologic assessments, development of conceptual site model, contaminant fate and transport modelling, human health risk assessment, development of property specific standards and preparation of risk management plan incorporating engineering risk management measures.

Toronto Economic Development Corporation, Corus Building, Queens Quay, Toronto, Ontario, 2008 to 2009

Senior risk assessor and environmental engineer for commercial re-development of waterfront brownfields site with metals and polycyclic aromatic hydrocarbon impacted soils. Provided senior technical review and oversight of design and implementation of engineering risk management measures including vapour mitigation system.

Confidential Client Ivy Lea Club, Phase Two ESA and Risk Assessment, Lansdowne, Ontario, 2009 to 2011

Senior risk assessor and environmental engineer for re-development of existing marina and resort located within the St. Lawrence River Thousand Islands and an environmentally sensitive wetlands area. Provided oversight and senior technical review of Phase One and Two environment assessments, prepared sampling and analysis plan, conducted geologic, hydrogeologic and data quality assessments, developed conceptual site model, conducted contaminant fate and transport modelling and human health risk assessment and developed property specific standards.

Urbancorp, Risk Assessment, 150 Sudbury Street, Toronto, Ontario, 2010 to 2011

Senior risk assessor and environmental engineer for re-development of brownfields industrial site with metals and polycyclic aromatic hydrocarbon impacted soils as a public roadway. Conducted geologic and hydrogeologic and data quality assessments, developed conceptual site model, conducted contaminant fate and transport modelling and human health risk assessment, developed property standards and prepared risk management plan incorporating engineering risk management measures.

Confidential Client Phase, Two Environmental Assessment and Risk Assessment, 181 John Street North, Hamilton, Ontario, 2009-2010

Senior risk assessor and environmental engineer for existing residential apartment building and chlorinated solvent impacted groundwater flow through condition. Conducted geologic, hydrogeologic and data quality assessments, developed conceptual site model, contaminant fate and transport modelling, human health risk assessment, developed property specific standards and prepared risk management plan incorporating engineering controls.

Confidential Client, Risk Assessment, Former American Standards Manufacturing Facility, 20 Guelph Avenue, Cambridge, Ontario, 2009 to 2010.

Senior risk assessor and environmental engineer for residential re-development of riverfront brownsfield site with metals, polycyclic aromatic hydrocarbon and petroleum hydrocarbon impacted soils and groundwater. Provided senior technical review, conducted geologic and hydrogeologic data quality assessments, developed conceptual site model, conducted contaminant fate and transport modelling and human health risk assessment, developed property specific standards and prepared risk management plan incorporating engineering risk management measures.

Confidential Client, Risk Assessment, 2300 Speers Road, Oakville, Ontario, 2010 - 2012

Senior risk assessor and environmental engineer for former manufacturing and existing warehouse facility with volatile organic compound and alcohol impacted soil and groundwater. Provided senior technical review, conducted geologic, hydrogeologic, data quality assessments, prepared toxicological profiles, conducted contaminant fate and transport modelling and human health risk assessment, developed property specific standards and prepared risk management plan incorporating engineering risk management measures.

Ontario Lottery and Gaming Corporation, Due Diligence Risk Assessments, Brantford, Niagara Falls, Sarnia, Sault Ste. Marie and Thunder Bay, Ontario, 2015 to 2016

Senior risk assessor and environmental engineer. Conducted screening level and due diligence risk assessments for five casino sites across Ontario encompassing data quality assessments, contaminant fate and transport modelling, development of conceptual site models, qualitative and quantitative risk analysis and development of groundwater sampling and soil management programs.

Multiple Clients, Screening Level and Due Diligence Risk Assessments, Multiple Sites in SouthwesternOntario, 2014 to 2017

Senior risk assessor and environmental engineer. Conducted screening level and due diligence risk assessments for 20 commercial and industrial Sites across southwestern Ontario including data quality assessments, contaminant fate and transport modelling, development of conceptual site models, qualitative and quantitative risk analysis, indoor air quality monitoring and development of groundwater sampling and soil management programs.

ENVIRONMENTAL SITE ASSESSMENTS AND REMEDIATION

Confidential Client, Site Remediation, 237 Lexington Street Waterloo, Ontario, 2017

Senior environmental engineer providing management and technical review for the remediation of petroleum hydrocarbon impacted soil in support of the re-development of an existing residential and institutional property.

Toronto Economic Development Corporation, Site Remediation, Corus Building, Queens Quay, Toronto, Ontario, 2008

Project engineer overseeing the remediation of metals and polycyclic aromatic hydrocarbon impacted soils for waterfront commercial re-development.

Greenfield Park Homes, Site Assessment, Remediation and Record of Site Condition, 6330 16th Avenue, Markham, Ontario, 2014 to 2015

Senior project engineer providing oversight and management of Phase One and Two Environmental Site Assessments, soil delineation and remediation programs, groundwater and landfill gas monitoring programs and stakeholder liaison in support of record of site condition filing for residential re-development of agricultural lands located near a former landfill site.

White Caps Property Management, Remediation and Risk Assessment, 142 -146 Speedvale Avenue West, Guelph, Ontario, 2014 to 2015

Senior project engineer providing oversight and management of remedial and monitoring programs and screening level risk assessment for former commercial property with petroleum hydrocarbon impacted soil and groundwater.

Barrick Gold, Remediation, Former Limestone Quarry, Milton, Ontario, 2004

Project engineer for the remediation of petroleum hydrocarbon impacted soil and groundwater in former quarry.

GSW Ltd, Remediation, GSW Manufacturing Facility, Fergus, Ontario, 2001 to 2003

Project engineer for in-Situ bioremediation and chemical oxidation of chlorinated solvent compound impacted soil and groundwater.

Confidential Client, Remediation and Drum Removal, Commercial Development, Mississauga, Ontario, 2000

Project engineer for the remediation of volatile organic compound impacted soils and removal of waste solvent drums.

Beaver Lumber Limited, Remediation, Beaver Lumber Property, Moncton, New Brunswick, 1999 to 2000

Project engineer for the in-Situ bioremediation of petroleum hydrocarbon impacted soils and groundwater.

SOIL VAPOUR AND METHANE MITIGATION SYSTEMS

Land Equity, Design and Construction, 214 Victoria Street, Simcoe, Ontario, 2014 to 2015

Project engineer for the design, specifications preparation, construction and performance optimization of active subslab depressurization system in existing industrial building as a risk management measure for control of chlorinated solvent vapour migration.

Confidential Client, Design and Construction, 150 Holiday Inn Drive, Cambridge, Ontario, 2014

Project engineer for the design, specifications preparation and construction of membrane barrier system in new commercial building as a risk management measure for control of chlorinated solvent vapour migration.

Joseph Brant Memorial Hospital, Design and Construction, Administration Building, Burlington, Ontario, 2013 to 2014

Project engineer for the design, tender specification and construction of methane membrane barrier and active venting systems for hospital administration building and parking garage.

Moriyama and Teshima Architects, Risk Management, Design and Construction, John McCrae Public School, Toronto, Ontario, 2013

Project engineer for risk management plan and tender preparation, design and construction of membrane barrier and active subslab depressurization systems for existing school building extension located near a closed former landfill site as mitigation measures for control of methane gas and volatile organic compound transport.

The Rose and Thistle Group, Design and Construction, 32 Atlantic Avenue, Toronto, Ontario, 2012

Project engineer for the design, specifications preparations and construction of passive subslab depressurization system in existing commercial building as a risk management measure for control of potential petroleum hydrocarbon vapour migration.

George Brown College, Design and Construction, George Brown College Waterfront Campus, Queens Quay, Toronto, Ontario, 2011

Project engineer for the design, specifications preparation and construction of active subslab depressurization system in promenade portion of waterfront academic building as a risk management measure for control of potential methane gas migration.

Auburn Developments, Design and Construction, Arrow Lofts Residential Development, Kitchener, Ontario, 112 Benton Street 112 Benton Street, 2010

Project Engineer for the design, specifications preparation and construction of membrane barrier and passive vapour mitigation systems in existing school extension located near a closed former landfill site as risk management measures for control of petroleum hydrocarbon vapour migration in former industrial building renovated for residential land use.

VAPOUR INTRUSION ASSESSMENTS

Confidential Client, Monitoring and Modelling, Miami County Incinerator Site, Miami County, Ohio, 2006

Project engineer for vapour intrusion pathway assessment of landfill derived impacts and development of property specific standards.

Confidential Client, Monitoring and Modelling, Muncie Racetrack Site, Delaware County, Indiana, 2006

Project engineer for vapour intrusion pathway assessment of chlorinated solvent groundwater impacts and development of property specific standards.

Confidential Client, Monitoring and Modelling, West Columbia Impoundments, West Columbia, Texas, 2006

Project engineer for vapour intrusion pathway assessment of chlorinated solvent impacts and development of property specific standards.

LANDFILLS

County of Norfolk, Design, North Walsingham Landfill Site and Simcoe Transfer Station, Norfolk County, Ontario, 2012

Project engineer for the design and tender specification for the construction of passive methane gas collection systems at two closed former landfill sites.

Confidential Client, Design and Approvals, Former Terrace Street Landfill Site, London, Ontario, 2014

Project engineer for the design, specifications preparation and environmental compliance approval for passive methane gas collection system residential development.

County of Lambton, Monitoring and Reporting, Sarnia Landfill Site, Sarnia, Ontario, 2005 to 2007

Annual performance reports for landfill leachate treatment system, groundwater and methane gas monitoring programs.

OTHER

London Health Sciences Centre, Modelling and Monitoring Services Completed, Victoria and University Hospitals, London, Ontario, 2016

Senior Project Engineer for fate and transport modelling and monitoring of sodium azide in sewer systems.

Liberty Mines, Management and Technology Evaluation McWatter's Mine, Timmins, Ontario, 2011

Project engineer evaluating management alternatives for the control of ammonia in mine wastewater discharges.

GSW Limited, System Operations, GSW Manufacturing Facility, Fergus, Ontario, 2005 to 2007

Project Engineer overseeing operation of chlorinated solvent impacted groundwater treatment system.

City of London, System Operations, Thames River Coal Tar Site, London, Ontario, 2003 to 2005

Project engineer overseeing operation of polycyclic aromatic hydrocarbon impacted groundwater treatment system.

Confidential Client, Modelling, Braidwood Generating Station, Braceville, Illinois, 2007

Project engineer for fate and transport modelling of tritium migration in groundwater near nuclear power plant.

City of Cambridge, Assessment and Monitoring 50 Dickson Street, Cambridge, Ontario, 2013 to 2015

Project engineer for assessment and monitoring of corrosion and water quality in building water distribution systems.

City of Hamilton, Monitoring and Assessment, Windemere Basin, Hamilton, Ontario, 2002

Project engineer evaluating dredging and end use alternatives for the management of metals and polycyclic aromatic hydrocarbon impacted sediments.

CAREER PATH

Since October	**Englobe Corp., Kitchener, Ontario** Senior Environmental Engineer
2017	**Exp Services Inc., Cambridge, Ontario** Senior Environmental Engineer
2008 - 2017	**Conestoga-Rovers & Associates, Waterloo, Ontario** Project Engineer
2001 - 2007	**Shaheen & Peaker Ltd., Toronto, Ontario** Project Engineer
1999 - 2000	**University of Guelph, Guelph, Ontario** Lecturer
1997	**University of Guelph, Guelph, Ontario** Graduate Teaching Assistant
1993 - 1997	**University of Western Ontario, London, Ontario** Graduate Teaching Assistant
1990 - 1992	**Fundy Guild / Environmental Canada Parks, Alma, New Brunswick** Environmental Technician
1989	**Crandall Engineering, Moncton, New Brunswick** Engineering Technician
1988	**Northumberland Dairy Ltd., Newcastle, New Brunswick** Process Engineer

PUBLICATIONS AND PRESENTATIONS

Harper, B.M., Stiver, W.H., and Zytner, R.G. The influence of water content on contaminant removal by SVE in a silt loam soil, J.Envir. Engrg., ASCE 124 (11), 1998

Harper, B. M., Stiver, W. H., and Zytner, R. G. Non-equilibrium nonaqueous phase liquid mass transfer model for soil vapour extraction systems, J. Envir. Engrg., ASCE 129(8): 745-754, 1998

Harper, B. M., Stiver, W. H., and Zytner, R. G. The effect of water and free liquid content on SVE contaminant mass transfer, Proc., 90th Annual meeting of the Air and Waste Management Association, Toronto, Ontario, 1997

Harper, B. M., Stiver, W. H., and Zytner, R. G. The influence of water content on soil vapour extraction performance, Proc., 89th Annual Meeting of the Air and Waste Management Association, Nashville Tennessee, 1996

AWARDS AND SCHOLARSHIPS

1991 - 1992 National Sciences and Engineering Research Council Scholarship, Western University, London, Ontario

1994 – 1995 National Sciences and Engineering Research Council Scholarship, University of Guelph, Guelph, Ontario

COMPUTER SKILLS

Computer languages; Fortran, Basic, PLI, Assembler

SOIL AND GROUNDWATER ASSESSMENT IN SUPPORT OF PROPOSED CONSTRUCTION PROJECT

DILLON CONSULTING

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Soil and Groundwater Assessment in Support of Proposed Construction Project

Port Weller Search and Rescue Station, 4 Welland Canals Parkway, St. Catharines, Ontario

DFRP # 86422
FCSI # 00013997

February 2019 – 18-8083

February 4, 2019

130 Dufferin Ave.
Suite 1400
London, Ontario
Canada
N6A 5R2
Telephone
519.438.1288
Fax
519.672.8209

Public Works and Government Services Canada
Environmental Services
4900 Yonge Street, 11th Floor
Toronto, Ontario
M2N 6A6

Attention: Aman Gill
Project Manager, Environmental Specialist

Soil and Groundwater Assessment
Port Weller Search and Rescue Station, 4 Welland Canals Parkway, St. Catharines, Ontario

Dillon Consulting Limited is pleased to provide you with the Soil and Groundwater Assessment report for the Port Weller Search and Rescue Station located at 4 Welland Canals Parkway, St. Catharines, Ontario.

We trust that the information provided herein is sufficient for your needs. Please contact the undersigned if you have any questions or comments or require additional information.

Sincerely,

DILLON CONSULTING LIMITED

Rachel Bryan, M.A.Sc., P.Eng.
Environmental Engineer

REB:caw
Enclosures

Our file: 18-8083

Table of Contents

Tables (in-text)

Tables

Figures

Appendices

Executive Summary

Dillon Consulting Limited (Dillon) was retained by Public Works and Government Services Canada (PWGSC) to conduct a Soil and Groundwater Assessment at the Port Weller Search and Rescue Station located at 4 Welland Canals Parkway, St. Catharines, Ontario. The assessment was required in support of construction of a new Canadian Coast Guard (CCG) Base. The investigation focuses on the demolition and construction areas and does not provide an assessment of environmental conditions elsewhere on the property.

The site is located on the west breakwater between Lake Ontario and the Welland Canal in St. Catharines, Ontario. The breakwater is roughly 80 m across (east-west) and was constructed in the early 1900s from dredged material from the canal and imported fill. The site is currently owned by the Saint Lawrence Seaway and leased by the Department of Fisheries and Oceans (DFO) for operation of a CCG Search and Rescue Station. The site covers an area of approximately 0.8 ha and comprises a boat launch, breakwater, floating docks, office/residence building, several storage/garage buildings, and an Environment Canada Hydrometric Gauging Station.

Soils at the site consist of shallow discontinuous and variable layers of sand, silt and gravel fill underlain by silty clay fill and native silty clay. The overburden is estimated to be 15 to 20 m thick in the vicinity of the site, overlying fractured shale bedrock. Potable groundwater wells in area are installed in the fractured shale bedrock aquifer. The shale bedrock aquifer is considered to have a low vulnerability to surface impacts due to the relatively thick layer of low permeability overburden.

Shallow groundwater flow within the silty clay fill is estimated to follow the topography of the site. On the east half of the breakwater, shallow groundwater is inferred to flow to the east towards the Welland Canal. On the west half of the breakwater, shallow groundwater is inferred to flow to the west towards Lake Ontario. A shallow groundwater divide is inferred to exist along the centreline of the breakwater. The hydraulic conductivity of the silty clay soil is very low, on the order of 10^{-8} to 10^{-9} m/s.

Based on our review of the available background reports, four areas of potential environmental concern (APECs) were identified within the construction area, as follows:

APEC 1: Importation of Fill Material of Unknown Quality – The breakwater was constructed in the early 1900s using dredged material from the Welland Canal and imported fill of unknown quality. A previous investigation identified soil and shallow groundwater exceedances of the applicable federal guidelines for metals and inorganics parameters. Contaminants of concern include metals and inorganics, PAHs, PHCs, and VOCs in soil and groundwater.

APEC 2: Fuel Storage and Handling – Six ASTs containing liquid fuels including diesel, gasoline, waste oil, and fuel oil, have been present on-site since as early as 1991. A diesel fuel dispenser and associated underground piping are also present on the eastern portion of the site. Contaminants of concern include PHCs, VOCs, and metals in soil and groundwater.

APEC 3: Possible Petroleum Contaminated Soil – Site personnel previously reported there was petroleum contaminated soil in the vicinity of the former lighthouse structure. The structure was demolished in the 1970s or 1990s and the upper layer of soil was reportedly removed. An asphalt cap (now the parking area east of the hoop house) was placed over the petroleum-impacted soils. Contaminants of concern include PHCs, VOCs, metals and inorganics in soil and groundwater.

APEC 4: Metals Impacts to Shallow Soil – Given the historical use of the site as a lighthouse and lightkeeper's residence from the 1930s to 1980s/90s, and as a CCG Base since the 1950s, metals impacts to surface soils are possible from use of galvanized metal materials and flaking lead based paints used on site structures. Contaminants of concern include metals in shallow soil.

An intrusive investigation was completed in August 2018 to investigate the four APECs. The investigation included advancement of 15 boreholes, collection of two shallow soil samples, and installation of five monitoring wells on the site. Rising head tests were completed on three of the monitoring wells to assess the hydraulic conductivity of the shallow silty clay fill.

A total of 24 soil samples (including three field duplicates) and six groundwater samples (including one field duplicate) were submitted for laboratory analysis of contaminants of concern. The soil samples selected for laboratory submission were considered to be representative of worst-case conditions in the boreholes based on field screening results, the location of the APECs, and observations of olfactory and visual characteristics. Two composite soil samples were submitted for TCLP analysis to classify the soils on-site for disposal purposes.

Soil and groundwater analytical results were compared to the applicable federal criteria for residential land use, fine textured soils, adjacent to surface water, and on-site potable groundwater use.

Based on the analytical results, impacts associated with APEC 2 (Fuel Storage and Handling) and APEC 3 (Possible Petroleum Contaminated Soil) were not identified. APEC 2 and APEC 3 are not considered Areas of Environmental Concern (AECs).

The investigation of APEC 1 (Importation of Fill Material of Unknown Quality) and APEC 4 (Metals Impacts to Shallow Soil) confirmed the presence of impacts to soil and/or groundwater above applicable criteria. The impacted areas are identified as AEC 1 and AEC 4 and described in the following table:

AEC	Name	Source	Contaminant Exceedances	Extent of Impacted Media
AEC 1	Metal-Impacted Impacted Fill	Unknown, but believed to be primarily from naturally-occurring minerals in the silty clay fill, which was dredged from the bottom of the canal and placed at the site to create the breakwater in the early 1900s.	Soil Soil sample 18-8, collected in the silty clay fill at a depth of 1.5-2.0 mbgs, contained 100 mg/kg of copper, exceeding the federal guideline of 63 mg/kg. Groundwater Aluminum, cobalt, copper, iron, lead and uranium exceeded the applicable federal guidelines and provincial background concentrations in one or more of the shallow monitoring wells on-site. The exceedances are based on the protection of freshwater aquatic life exposure pathway.	Soil The copper impacts are estimated to be relatively localized, given that 16 other soil samples from across the site were submitted for copper analysis and all of them met the applicable guideline. Partial horizontal delineation of the copper-impacted fill has been established to the south (by sample 18-2a) and west (by sample 18-9). Vertical delineation has not been established. Groundwater The horizontal and vertical extents of metals exceedances in groundwater have not been delineated. All four of the wells that were sampled contained exceedances. The wells are screened within the silty clay fill at a depth of 4.5 -6.1 mbgs. The silty clay fill was used to construct the breakwater and is present across the entire site extending to an estimated depth of 9 to 12 mbgs.
AEC 4	Lead Impacts to Shallow Soil	Historical flaking lead-based paint on the lightkeeper's residence.	Shallow soil sample GS2 contained lead at a concentration of 216 mg/kg, exceeding the federal guideline of 140 mg/kg.	GS2 was collected at a depth of 0.0-0.3 mbgs in the silty sand and gravel fill soil on the east side of the former lightkeeper's residence. Horizontal and vertical extents of the lead-impacted soil area have not been delineated.

The soil and groundwater exceedances are based on the following receptors and exposure pathways:

- AEC 1: The soil exceedance for copper is based on ecological direct soil contact for plants and invertebrates. This soil exceedance does not represent a concern for human receptors at the site. The groundwater exceedances for aluminum, copper, iron, lead and uranium are based on the groundwater to surface water pathway, with freshwater aquatic life receptors in the Welland Canal and Lake Ontario. The groundwater exceedances do not represent a concern for human receptors at the site
- AEC 4: The shallow soil exceedance for lead is based on human soil ingestion for site residents, with fetuses (i.e., pregnant women) as the most sensitive receptors that may potentially reside on-site. This exceedance represents a low level risk for pregnant coast guard personnel who may be living and working on-site. It is noted that, for site workers and visitors who do not reside on-site, the concentration of lead in soil meets the applicable Tier 1 generic guideline for commercial land use, which is considered to be protective of non-resident site workers and visitors.

TCLP analysis results show that the soil on the site can be considered non-hazardous. Excess soil removed from the site during construction may be disposed of at a facility licensed to accept contaminated, non-hazardous waste.

Overall, the investigation characterized the soil and groundwater conditions at the site within the construction area. Complete delineation of the AECs was not achieved through this investigation. Additional horizontal and vertical delineation of the AECs would be required in order to provide estimates of impacted area and/or volume of the contaminated media.

The following recommendations are provided for consideration:

Construction-related recommendations:

- The contaminated soil on site should not be reused on the site
- Soil generated through excavation during the construction should be disposed of at a facility licensed to accept non-hazardous waste. A receiving site should be identified by the contractor
- Clean backfill is required and should be tested
- Methods should be implemented to ensure that recontamination of the clean backfill does not occur (ex., installing a geotextile liner)
- Methods should be implemented to ensure that contamination is not spread at the site
- Decontamination measures should be implemented when working with the contaminated media
- The contractor should implement mitigation measures to prevent contamination of the site from lead-based paints and other potentially contaminating materials during demolition and construction activities
- The new well to be drilled as part of the construction project must be installed in the bedrock aquifer and sealed through the overburden fill and soils

- If construction dewatering is required, further characterization of the groundwater may be required depending on how the excess groundwater is managed
  - The contractor will need to determine the volume of water they expect to generate during dewatering in order to determine whether the water can be managed on-site or whether it will need to be hauled off-site for disposal
  - If volumes are minimal, groundwater pumped from excavations can be placed in holding tanks on-site and tested to ensure water quality is suitable for discharge to ground surface
  - If, based on anticipated volumes or other considerations, the contractor decides that groundwater should be removed by vac truck for off-site disposal, the contractor will need to identify a receiver for the groundwater (e.g., licensed treatment facility, municipal sewer). Additional testing may be required by the receiver.
  - In Ontario, a provincial Permit to Take Water (PTTW) is required for construction dewatering over 50,000 L/day under Section 34 of the *Ontario Water Resources Act*. Since the site is federally-owned, a PTTW is not required; however, if water takings are anticipated to exceed 50,000 L/day, the construction manager may recommend that the contractor obtain a PTTW to be consistent with provincial regulations.

Management-related recommendations

- Surface water quality in the Welland Canal and Lake Ontario should be tested to determine whether the water quality meets the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life for metals parameters including aluminium, cobalt, copper, iron, lead, and uranium, which were found to exceed the Federal Interim Groundwater Quality Guidelines (FIGQG) in one or more shallow groundwater monitoring wells on the site. The FIGQG values that were exceeded are based on the migration of groundwater to surface water and exposure of freshwater aquatic life receptors
- Delineation of copper and lead exceedances in soil (AEC 1 and AEC 4) should be completed. Following delineation, a Risk Management/Remedial Options Evaluation should be completed
- Lead based exterior paint on site structures should be inspected annually and maintained in good condition to prevent contamination of shallow soils at the site from flaking paint.

1.0 Introduction

1.1 Introduction

Dillon Consulting Limited (Dillon) was retained by Public Works and Government Services Canada (PWGSC), to conduct a Soil and Groundwater Assessment at the Port Weller Search and Rescue Station located at 4 Welland Canals Parkway, St. Catharines, Ontario. The Port Weller Search and Rescue Station is identified in the Directory of Federal Real Property (DFRP) as site number 86422 and in the Federal Contaminated Sites Inventory (FCSI) as site number 00013997. A site location map is provided as **Figure 1**.

The assessment is required in support of construction of a new Canadian Coast Guard (CCG) Base. The proposed construction activities at the site will include demolition of some existing structures and subsurface infrastructure, construction of new buildings, and installation of new underground services including a new potable water well, new septic system, and associated underground piping. Buildings are to be slab on grade construction with no basements. The existing 1930s lightkeeper's residence is to remain, the existing 1950s building (Office/House) and ancillary buildings (garage, shop) are to be demolished. A demolition site plan and new construction site plan are provided as **Figure 3a** and **Figure 3b**. The Soil and Groundwater Assessment focuses on the demolition and construction areas and does not provide an assessment of environmental conditions elsewhere on the property.

1.2 Background

The site is located on the west breakwater between Lake Ontario and the Welland Canal in St. Catharines, Ontario. It is currently owned by the Saint Lawrence Seaway and leased by the Department of Fisheries and Oceans (DFO) for operation of a CCG Search and Rescue (SAR) Station. The site covers an area of approximately 0.8 ha and comprises a boat launch, breakwater, floating docks, office/residence building, several storage/garage buildings, and an Environment Canada Hydrometric Gauging Station.

Six aboveground storage tanks (ASTs) containing fuel oil, gasoline, diesel and waste oil are present around the office/residence building. One of the diesel ASTs is connected via underground piping to a fuel dispenser at the docks. Two drums containing bilge water and an underground septic tank are also present on-site.

Eleven (11) background reports pertaining to the site were provided to Dillon by PWGSC. The following table summarizes the salient points from the reports:

Table 1-1 Summary of Background Reports Reviewed

<table>
<tr><th>Report</th><th>Summary</th></tr>
<tr><td>Phase I Environmental Site Assessment, Conor Pacific Environmental Technologies Inc., 1998</td><td>- This investigation was conducted for the Outer Light, which lies approximately 900 m north of the site
- The report is relevant for historical context and regional information
- Between 1909 and 1931 the mouth of Ten Mile Creek was extended to create an artificial harbour (Port Weller Harbour). The breakwater was manmade through placement of dredged material from the canal, rubble, stone and fill
- The Outer Light was constructed in 1931 and an emergency pier head light was added in 1947. It is now recognized as a Federal Heritage Structure
- Lead based paint was identified on the interior and exterior of the Outer Light, no other environmental concerns were identified.</td></tr>
<tr><td>Fuel Storage Tank Assessment and Upgrade Report, CH2M HILL, 2003</td><td>- The consultant was retained to complete fuel storage tank assessments and upgrades at the Port Weller SAR Station
- Six ASTs were identified on-site, as follows:
<table>
<tr><th>Tank Capacity (L)</th><th>Contents</th><th>Purpose</th><th>Year of Installation (approx.)</th></tr>
<tr><td>1,100</td><td>fuel oil</td><td>Furnace fuel (house)</td><td>1997</td></tr>
<tr><td>910</td><td>diesel</td><td>Emergency generator</td><td>1996</td></tr>
<tr><td>935</td><td>fuel oil</td><td>Furnace fuel (SAR bldg)</td><td>2000</td></tr>
<tr><td>11,000</td><td>diesel</td><td>Motive fuel for vessels</td><td>1991</td></tr>
<tr><td>1,900</td><td>gasoline</td><td>Motive fuel for vessels</td><td>1993</td></tr>
<tr><td>500</td><td>waste oil</td><td>From vessels</td><td>1991</td></tr>
</table>
- Operational and compliance deficiencies were identified for all of the tanks
- A visual inspection of the surface below and surrounding the tanks was not conducted due to snow cover; however, oil drips were observed below the manual shutoff valve and filter at the bottom of the 1,100-L fuel oil AST.</td></tr>
<tr><td>Environmental Compliance Audit, Jaques Whitford, 2007</td><td>- The consultant was retained to complete an environmental audit of the Port Weller SAR Station. The audit period was January 1, 2005, to August 14, 2007. Audit topics included: air emissions; fuel handling and storage tank management; water consumption and wastewater management; soil, water and groundwater quality; non-hazardous soil waste; hazardous materials and hazardous waste; and, environmental emergency response
- Records keeping and housekeeping were described as well-organized and well-maintained
- The same six ASTs identified by CH2M HILL in 2003 were present on-site
- Waste oil is removed for off-site disposal by a contractor. Bilge water from vessels contains potentially hazardous substances and is stored in 200-L drums and removed for off-site disposal. The site is registered with a waste generator number under the Ontario Hazardous Waste Information Network (HWIN) and the removal and disposal of the waste is tracked through the waste manifest system
- The Commanding Officer on-site reported that there used to be a lighthouse at the SAR Station. According to the Commanding Officer, the lighthouse was decommissioned circa 1997. (Note: historical information available online suggests the lighthouse was decommissioned in the 1970s). According to the Officer, testing completed at that time identified petroleum hydrocarbon contamination in the soil where the parking lot now exists. The upper 0.5 m of soil was removed from the area and an asphalt driveway was installed to cap the hydrocarbons. No documentation of the investigation or remediation was available.</td></tr>
</table>

Report	Summary

CCME Phase I/II Environmental Site Assessment, Aqua Terre Solutions Inc., 2009	- Three potential areas of concern (PACs) were identified based on the Phase I ESA:
	  ○ PAC-1: Six ASTs are present on-site. Soil and groundwater quality in the vicinity of these ASTs is unknown and should be evaluated
	  ○ PAC-2: The quality of fill used to construct the breakwater is unknown. Fill quality should be evaluated in conjunction with PAC-1
	  ○ PAC-3: The quality of sediments adjacent to the site is unknown and should be evaluated
	- Phase II soil sampling was conducted with Pionjar drilling equipment in the vicinity of the ASTs. Eight boreholes (BH-101 to BH-108) were drilled to depths ranging from 1.2 to 2.1 m below ground surface (mbgs). Soils were described as silt and clay fill. Groundwater monitoring wells were not installed
	- Soil samples were submitted for laboratory analyses of one or more of benzene, toluene, ethylbenzene and xylenes (BTEX); petroleum hydrocarbons (PHCs), inorganics, polycyclic aromatic hydrocarbons (PAHs), pH and grain size. A water sample was collected from the potable water supply well. There was insufficient sediment to sample in the Welland Canal
	- The results of the Phase II ESA found:
	  ○ PAC-1: No PHC soil impacts were encountered in the vicinity of the ASTs. It was concluded that the tanks have little subsurface impacts, if any
	  ○ PAC-2: Shallow soil sampling of fill underlying the site was conducted in conjunction with soil sampling around the ASTs. No poor quality fill was encountered and it was concluded that fill quality is not a concern
	  ○ PAC-3: Sediment sampling was attempted; however, there was insufficient sediment to sample and it was concluded that sediment quality is not a concern
	  ○ Water sampled from the potable water supply well met Canadian Drinking Water Quality Guidelines except for sodium, which is an aesthetic parameter.

Compliance Audit of Storage Tank Systems, DST Consulting Engineers, 2010	- The same six ASTs, described by CH2M HILL in 2003, were audited for compliance with federal and provincial regulations - Operational and compliance deficiencies were identified for all of the tanks - No new information with respect to soil and groundwater quality or potential environmental concerns were identified in this report that had not been previously identified through other sources.

<table>
<tr><th>Report</th><th>Summary</th></tr>
<tr><td>Completion of Tank System Upgrade Program, SNC-Lavalin Environment, 2011</td><td>
- The consultant was retained to assist with project management, coordination, and QA/QC during AST upgrades
- The two heating fuel oil ASTs were removed and replaced with two new 1,100-L tanks. The new tanks were relocated slightly (1 to 2 m from previous locations) in order to maintain a minimum distance of 1.5 m from buildings
- The existing 11,000-L diesel fuel AST was also relocated slightly
- Other upgrades were completed as detailed in the report
- Following completion of the work, the inventory of ASTs was as follows:
<table>
<tr><th>Tank Capacity (L)</th><th>Contents</th><th>Purpose</th><th>Year of Installation (approx.)</th></tr>
<tr><td>1,100</td><td>fuel oil</td><td>Furnace fuel (house)</td><td>2011</td></tr>
<tr><td>910</td><td>diesel</td><td>Emergency generator</td><td>1996</td></tr>
<tr><td>1,100</td><td>fuel oil</td><td>Furnace fuel (SAR bldg)</td><td>2011</td></tr>
<tr><td>11,000</td><td>diesel</td><td>Motive fuel for vessels</td><td>1991</td></tr>
<tr><td>1,900</td><td>gasoline</td><td>Motive fuel for vessels</td><td>1993</td></tr>
<tr><td>500</td><td>waste oil</td><td>From vessels</td><td>1991</td></tr>
</table>
- No new information with respect to soil and groundwater quality or potential environmental concerns were identified in this report.
</td></tr>
<tr><td>Storage Tank System Hardware Compliance Program, XCG Consultants Ltd., 2016</td><td>
- The consultant was retained to complete a compliance audit of the six fuel ASTs
- No new information with respect to soil and groundwater quality or potential environmental concerns were identified in this report.
</td></tr>
<tr><td>Storage Tank System Upgrades, XCG Consultants Ltd., 2017</td><td>
- The consultant was retained to complete tank system upgrades
- No new information with respect to soil and groundwater quality or potential environmental concerns were identified in this report.
</td></tr>
<tr><td>Final Geotechnical Investigation Report, Englobe, 2018</td><td>
- The consultant was retained to complete a geotechnical investigation for a proposed new residence building, which will be a 186 square meter (2,000 square foot) single-storey structure with no basement
- The existing 1930s lightkeeper’s residence is to remain, the existing 1950s building (Office/House) and ancillary buildings (garage, shop) are to be demolished
- Six boreholes were advanced to between 2.1 and 6.7 mbgs. A monitoring well was installed in BH6 (1.5-m screen from 4.5-6.1 mbgs)
- Select soil samples and one groundwater sample were analyzed for PHCs, volatile organic compounds (VOCs), PAHs, metals, and inorganics
- The fill is described as silty sand/sandy silt/silty clay/sand and gravel/sandy silty clay/clayey silt
- Silty clay, some sand to sandy was encountered below the upper fill layer
- Groundwater was measured at 1.7 mbgs in BH6
- Results showed exceedances of federal Tier 1 standards for beryllium, copper, lead, and zinc in fill soil at BH2 and groundwater exceedances for chloride and uranium at BH6.
</td></tr>
</table>

Report	Summary
Updated Phase I Environmental Site Assessment, Englobe, 2018	- The consultant was retained to complete a Phase I ESA prior to proposed construction activities at the site - A Hazardous Building Materials Assessment was completed on the main building in 2014 by Pinchin and again by DST in 2017. Asbestos containing materials (ACM), lead, mercury and silica were identified - A Geotechnical Investigation was conducted in 2017 by Englobe – six boreholes were advanced to depths of 2.1 and 6.7 mbgs. One groundwater monitoring well was installed. Soil and groundwater samples were analyzed for PHCs, VOCs, PAHs, and metals and inorganics o Four metals (Be, Cu, Pb, Zn) exceeded the applicable Canadian Environmental Quality Guidelines (CEQG) in surface soil (0.0 - 0.6 mbg) sampled at borehole BH2 o Chloride and uranium concentrations exceeded the applicable Federal Interim Groundwater Quality Guidelines (FIGQG) at monitoring well BH6 - Based on the results of the Phase I ESA, one Area of Environmental Concern (AEC) and one Area of Potential Environmental Concern (APEC) were identified, as follows: o AEC 1: Fill material of unknown quality was used to create the breakwater on which the site is situated. Exceedances of the applicable federal guidelines for several metals and inorganics parameters in soil and groundwater were reported during a 2017 geotechnical investigation o APEC 1: Current and historic fuel oil, gasoline, diesel, waste oil, and bilge water storage and handling on-site since the early 1990s. Potential contaminants of concern include PHCs, VOCs and metals.
Project-Specific Designated Substances Survey (DSS), DST, 2018	- The consultant was retained to complete a DSS of the Office House, Galley House (aka lightkeeper's dwelling), adjoining building (breezeway), Rope Locker, Hoop House, and Storage Building prior to proposed demolition and construction activities at the site - Non-friable asbestos-containing materials (ACMs) were identified as follows: tar applied to the wall of the Office House basement, black mastic applied to a layer of plywood subfloor in the Galley House, and exterior caulking used on several building windows - Lead based paints were identified on six interior and four exterior surfaces - All four of the exterior lead-based paints were found on the Galley House. The lead content in the four exterior paints ranged from 1,400 mg/kg to 160,000 mg/kg. The paints were noted to be in good condition at the time of the inspection.

Based on Dillon's review of the above-noted background reports, four APECs were identified within the construction area. The APECs are summarized in the following table and illustrated on **Figure 2**:

Table 1-2 Summary of Areas of Potential Environmental Concern (APECs)

APEC #	Description	Contaminants of Potential Concern and Potentially Impacted Media
1	***Importation of Fill Material of Unknown Quality*** - The site lies on the west breakwater at the entrance to the Welland Canal. The breakwater was constructed between 1909 and 1930 using dredged and imported fill materials of unknown environmental quality - The fill was identified as AEC 1 in the previous Phase I ESA (Englobe, 2018b) - Exceedances of chloride and uranium were identified in shallow groundwater at monitoring well BH6 during a previous geotechnical investigation (Englobe, 2018a) - Exceedances of beryllium, copper, lead, zinc, and pH were reported in a shallow soil sample (0-0.6 mbgs) collected during a previous geotechnical investigation at the site (Englobe, 2018a).	M&I, PAHs, PHCs, VOCs in soil and groundwater
2	***Fuel Storage and Handling*** - Six ASTs containing liquid fuels including diesel, gasoline, waste oil, and fuel oil, have been present on-site since as early as 1991 - A diesel fuel dispenser and associated underground piping are also present on the eastern portion of the site - Previous sampling in 2009 did not identify subsurface fuel-related impacts in the vicinity of the ASTs, however, ten years have passed since this investigation - Fuel storage and handling was identified as APEC 1 in the previous Phase I ESA (Englobe, 2018b).	PHCs, VOCs and metals in soil and groundwater
3	***Possible Petroleum Contaminated Soil*** - The 2007 Environmental Compliance Audit by Jacques Whitford references reported petroleum contaminated soil in the vicinity of the former lighthouse structure, which was demolished in the 1970s or 1990s. CCG personnel reported the upper layer of soil was removed and an asphalt cap (now the parking area east of the hoop house) was placed over the petroleum-impacted soils.	PHCs, VOCs, M&I in soil and groundwater
4	***Metals Impacts to Shallow Soil*** - Given the historical use of the site as a lighthouse and lightkeeper's residence from the 1930s to 1980s/90s, and as a CCG Base since the 1950s, metals impacts to surface soils are possible from use of galvanized metal materials and flaking lead based paints used on site structures.	Metals in shallow soil

Notes:
BTEX = Benzene, toluene, ethylbenzene and xylenes
M&I = Metals and inorganics
PAHs = Polycyclic aromatic hydrocarbons
PHCs = Petroleum hydrocarbons (fractions F1 to F4)
VOCs = Volatile organic compounds

1.3 Objectives

In general, the purpose of the assessment is to characterize the soil and groundwater conditions at the site within the construction area. The objectives of the assessment include:

- Confirm the absence or presence of AECs in relevant media of concern within the construction area
- Characterize the nature and level of contaminants for AECs within the construction area
- Identify detailed soil, geological, hydrogeological and hydrological conditions on the site
- Complete delineation of the AECs in the affected media
- Develop a conceptual site model
- If contaminated soil and groundwater are identified, determine the area and/or volume of the contaminated media
- Provide recommendations for managing/remediating contaminated soil and/or groundwater during the construction and associated costs.

1.4 Scope of Work

The scope of work included the advancement of 15 boreholes and installation of five monitoring wells on the site. Two shallow grab samples were also collected to assess potential metals impacts to shallow soil. Grab sample, borehole, and monitoring well locations are illustrated on the demolition and new construction site plans provided as **Figure 3a** and **Figure 3b** and summarized in the following table:

Table 1-3 Summary of Drilling and Sampling Locations

Borehole/ Grab Sample ID	Monitoring Well Installed?	Depth of Borehole (mbgs)	Location	APECs Investigated	Rationale
18-1	No	6.1	Southwest corner of the existing residence	1, 2	Investigate potential impact from AST No. 1 (1,100-L fuel oil) and investigate shallow fill quality
18-2	No	6.1	West of emergency generator room	1, 2	Investigate potential impact from AST No. 2 (910-L fuel oil) and characterize fill soil quality within anticipated excavation area for new septic tank
18-3	No	4.5	South of Rope Locker building	2	Investigate potential impact from AST No. 3 (935-L diesel)
18-4	Yes	6.1	North of diesel fuel dispenser	2	Investigate potential impact from fuel dispensing activities and associated underground piping
18-5	Yes	6.1	Northeast corner of existing lightkeeper's residence	2, 4	Investigate potential impact from former lighthouse and existing lightkeeper's residence structures, potential impact from AST No. 4 (11,000-L diesel) and associated underground piping

Borehole/ Grab Sample ID	Monitoring Well Installed?	Depth of Borehole (mbgs)	Location	APECs Investigated	Rationale
18-6	No	4.5	North of AST No. 4	2, 4	Investigate potential impact from AST No. 4 (11,000-L diesel) and former lighthouse
18-7	Yes	6.1	East of existing hoop house	3	Investigate reported PHC-impacts to soil beneath the asphalt-paved parking area
18-8	Yes	6.1	East of existing waste oil and gasoline ASTs	2	Investigate potential impact from AST No. 5 (1,900-L gasoline), AST No. 6 (500-L waste oil) and drums of bilge water
18-9	No	4.5	West of existing waste oil and gasoline ASTs	2	Investigate potential impact from AST No. 5 (1,900-L gasoline), AST No. 6 (500-L waste oil) and drums of bilge water
18-10	No	3.0	Within footprint of proposed new septic bed	1	Investigate fill quality within proposed septic bed as excavation of some of this material is likely during construction
18-11	No	4.5	Within footprint of proposed new garage/utility building	1	Investigate fill quality
18-12	No	1.5	Within footprint of proposed new garage/utility building	1	Investigate fill quality to determine whether soil that may be excavated during construction in this area is contaminated and determine potential for indoor air quality concerns for the future building
18-13	Yes	6.1	East of existing septic bed	1	Investigate fill soil and groundwater quality downgradient of the existing septic bed
18-14	No	3.0	East of existing storage building	1	Investigate fill quality in gravel parking area
18-15	No	3.0	East of existing wooden garden storage structure	1	Investigate fill quality in gravel parking area
GS1	No	0.3	Vicinity of previous geotechnical borehole BH2	1	Shallow grab sample to confirm previous metals impacts in shallow fill in this area
GS2	No	0.3	East of lightkeeper's residence	4	Shallow grab sample to assess potential metals impacts in surface soil from lightkeeper's residence

In addition to the five monitoring wells installed as part of this investigation, one pre-existing monitoring well was also identified at the site. The monitoring well was installed in 2017 during a geotechnical investigation by Englobe (Englobe, 2018a). The well, identified as BH6, is located southwest of the existing office building (**Figure 3a**) and within the footprint of the proposed new living quarters (**Figure 3b**). The monitoring well was in good condition and deemed to be suitable for monitoring and sampling.

A summary of the investigation for each APEC is provided in the following table.

Table 1-4 Investigation Summary by APEC

APEC	Boreholes Drilled	Monitoring Wells Installed/Sampled	Rationale
1	18-1 18-2 18-8 18-10 18-11 18-12 18-13 18-14 18-15 GS1	18-4 18-5 18-8 18-13 BH6 (installed in 2017)	Collect soil and groundwater samples to investigate potential impacts to soil and groundwater from the importation of fill of unknown quality within the construction areas
2	18-1 18-2 18-3 18-4 18-5 18-6 18-8 18-9	18-4 18-5 18-8	Collect soil and groundwater samples to investigate potential impacts to soil and groundwater from fuel storage and handling activities
3	18-7	18-7 (dry)	Investigate reported PHC-impacts to soil beneath the asphalt-paved parking area east of the former lighthouse
4	18-5 18-6 GS2		Collect shallow soil samples to assess potential metals impacts in surface soil from lightkeeper's residence and former lighthouse

1.5 Applicable Environmental Guidelines

1.5.1 Basis for Criteria Selection

Soil and groundwater analytical results were compared to the applicable federal criteria for residential land use, fine textured soils, adjacent to surface water, and on-site potable groundwater use.

The applicable environmental guidelines for the site were selected based on the following:

- The site is owned by the Saint Lawrence Seaway (a federal works and undertaking), therefore federal criteria are applicable
- The site is currently developed for residential and commercial land uses. There is no land use change proposed for the site, therefore the more stringent residential land use criteria were selected
- Human receptors are adults. Children, toddlers and infants do not reside on-site; however pregnant women could potentially live and work on-site
- Potable water at the site is currently sourced from an on-site water well. There is no well record available in the Ontario Water Wells Database for the site water well; however, a review of well records in the vicinity of the site show water wells in the area are installed in the shale bedrock aquifer, roughly 15 to 20 mbgs. The bedrock aquifer is hydraulically isolated from surface by 15 to 20 m of clay overburden, which acts as an aquitard. A new water well will be drilled on-site as part of the proposed construction, this well will presumably be installed in bedrock. To protect potable water resources, the Guidelines for Canadian Drinking Water Quality (GCDWQ) were used as one of the applicable assessment guidelines for groundwater quality. It should be noted that groundwater samples were collected from shallow overburden monitoring wells, which do not represent the potable water supplies in the area; nonetheless, the GCDWQ were used as comparison criteria for due diligence
- The site is bounded by the Welland Canal to the east and Lake Ontario to the west. Groundwater quality within 10 m of surface was assessed on the basis of the protection of freshwater aquatic life
- Three grain size analyses were completed by Englobe in 2017 as part of the previous geotechnical investigation (Englobe, 2018a). The samples were collected from three different boreholes within the construction area at depths of 0.8-1.4 mbgs, 1.5-2.1 mbgs, and 4.5-5.2 mbgs. Grain size analysis results showed all three samples consisted of sandy silty clay with varying amounts of gravel. This is consistent with the predominant soil type observed during the present investigation, which was described as a silty clay. Since the soils consist of more than 50 per cent by mass of particles smaller than 75 µm in diameter, the fine textured soil standards are applicable.

1.5.2 Soil

Soil analytical results were assessed using the following applicable federal guidelines:

- Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CSQG) (updated and available online at http://st-ts.ccme.ca/en/index)
- Canadian Council of Ministers of the Environment (CCME) Canada-Wide Standards for Petroleum Hydrocarbons in Soil. Revised January, 2008.

The guidelines follow a tiered framework. The tiers are:

- Tier 1: Direct application of the generic numerical guidelines; specifically, application of the lowest guideline for any pathway
- Tier 2: Allows for the development of site-specific remediation objectives through the consideration of site-specific conditions, by modifying (within limits) the numerical guidelines based on site-specific conditions and focusing on exposure pathways and receptors that are applicable to the site.

For this assessment, soil analytical results were compared to the Tier 1 generic guidelines for residential land use with fine-textured soils.

For parameters exceeding the Tier 1 generic guidelines, the limiting exposure pathway driving the Tier 1 generic guidelines was found to be applicable at the site and therefore a Tier 2 evaluation was not completed.

1.5.3 Groundwater

Groundwater analytical results were assessed using the most stringent criteria from following applicable federal guidelines:

- Guidelines for Canadian Drinking Water Quality (GCDWQ) (HC, revised February 2017)
- Federal Interim Groundwater Quality Guidelines (FIGQG) for Federal Contaminated Sites (FCSAP, revised June 2016).

For monitoring well 18-4, which is located within 10 m of a surface water body, the Canadian Water Quality Guidelines for the Protection of Aquatic Life (updated and available online at http://st-ts.ccme.ca/en/index), were also used for comparison.

The FIGQG and the CWQG follow a tiered framework, similar to the CSQG. For this assessment, groundwater analytical results were compared to the Tier 1 generic guidelines for residential land use with fine-textured soils. For parameters exceeding the Tier 1 generic guidelines, the limiting exposure pathway driving the Tier 1 generic guidelines was found to be applicable at the site and therefore a Tier 2 evaluation was not completed.

The GCDWQ specify Maximum Allowable Concentration (MAC) values based on human health as well as guidelines based on Aesthetic Objectives (AO) and Operational Guidelines (OG). If a parameter exceeded a MAC value, this was considered an environmental concern based on the protection of human receptors at the site. If a parameter exceeded an AO or OG, the exceedance was noted in **Section 3.6.1** but was not considered to represent an environmental concern for the site.

1.5.4 Use of Provincial Standards in the Absence of Federal Guidelines

For parameters with no criteria specified under the above-noted federal guidelines, the provincial standards were used for comparison. The applicable provincial standards are the Table 8: Generic Site Condition Standards (SCS) for Use within 30 m of a Water Body in a Potable Groundwater Condition, set out in "Soil, ground water and sediment standards for use under Part XV.1 of the *Environmental Protection Act*", published April 15, 2011, herein referred to as the "Table 8 SCS". The Table 8 SCS are applicable under *Ontario Regulation (O. Reg.) 153/04 – Records of Site Condition.*

For assessment of the human health effects of non-carcinogenic PAHs in soil, the lowest of the human health based component values used to derive the Table 8 SCS were applied. Component values are set out in "Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario", dated April 15, 2011.

1.5.5 Comparison to Background Levels

A "contaminated site" is defined by the Treasury Board of Canada Secretariat as "*one at which substances occur at concentrations (1) above background (normally occurring) levels and pose or are likely to pose an immediate or long-term hazard to human health or the environment, or (2) exceeding levels specified in policies and regulations*." The term "levels" refers to federal environmental quality guidelines or, if federal guidelines are not available, guidelines from other jurisdictions that offer a comparable level of protection. Sites with marginal / localized exceedances or exceedances that are similar to background should be assessed using multiple lines of evidence.

Parameter concentrations that exceeded the above-noted federal guidelines were also compared to provincial background concentrations. Background concentrations for contaminants of concern in Ontario are set out in Table 1: Full Depth Background Site Condition Standards in "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*", April 2011 (herein referred to as the "Table 1 SCS"). The Table 1 SCS are background values derived from the Ontario Typical Range values for the land uses indicated and are considered representative of upper limits of typical province-wide background concentrations in soil, sediment, and groundwater that are not contaminated by point sources.

Parameters that were found to be present at concentrations below the Table 1 SCS were not considered to be contaminants.

2.0 Investigation Methodology

2.1 General

Intrusive soil sampling and groundwater sampling from the boreholes advanced and monitoring wells installed as part of the drilling investigation were used to investigate the subsurface conditions at the site. A groundwater sample was also collected from pre-existing monitoring well BH6 and rising head tests were completed at three of the monitoring wells (18-5, 18-8 and 18-13) to assess hydraulic conductivity. Details of the investigation are described in the following sections. Photographs of the site and investigation are provided in **Appendix D**. Drilling, soil sampling, and monitoring well installation activities were supervised by Dillon personnel. Field notes were recorded in a dedicated field book, which is retained on file.

The assessment was completed using the following guidance documents:

- CSA Z769-00 standard, Phase II Environmental Site Assessment (R2013)
- CCME's Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment, Volumes 1 to 4 (2016)
- CCME's Subsurface Assessment Handbook for Contaminated Sites, 1994 (CCME catalogue: http://www.ccme.ca/files/Resources/csm/pn_1144_e.pdf).

2.2 Utilities Locates

Ontario One Call was contacted on July 26, 2018, and also on August 11, 2018, to coordinate public utilities locates for the investigation. The following owners of underground infrastructure in the area were notified by Ontario One Call:

- PVS for Horizon Utilities – St. Catharines Hydro
- PVS for Enbridge Gas
- PVS for Bell Canada.

PVS met Dillon field personnel on-site on the morning of August 14, 2018, and completed the public utilities locates for underground hydro, gas, and communications lines prior to commencement of drilling activities that morning. A copy of the public utilities locates is provided in **Appendix E**.

Frontier Utility Locating Inc. was retained by Dillon to locate private utilities on-site. Dillon field personnel met the private locator on-site on August 10, 2018, to layout the borehole locations and complete the private utilities locates. The locator scanned the site and borehole locations for power, radio, and inductive signals. Non-conductive lines including but not limited to some sewer and water lines were noted to be not detectable. A copy of the private utilities locates is provided in **Appendix E**.

2.3 Drilling

The drilling program was completed on August 14 and August 15, 2018. A total of fifteen boreholes (18-1 to 18-15) were advanced on the site. Monitoring wells were installed in five of the boreholes to allow for groundwater sampling. The boreholes were advanced using dual tube soil samplers. Monitoring wells were installed using 108 mm diameter solid stem augers. Drilling was completed using a track-mounted Geoprobe 7822DT drill rig operated by Direct Environmental Drilling Inc. The borehole and monitoring well locations are shown on the Site Plans provided as **Figure 3a** and **Figure 3b**.

The boreholes were advanced to depths ranging from 1.5 mbgs to 6.1 mbgs. Upon completion of the soil sampling activities the boreholes were either backfilled with bentonite pellets to surface or equipped with monitoring wells to allow for groundwater sampling.

Soil cuttings generated during drilling activities were drummed and removed for off-site disposal at APEX Environmental Services Inc. in Barrie, Ontario, on October 16, 2018. Copies of the work order and certificate of destruction are provided in **Appendix F**.

2.4 Soil Sampling

Continuous soil sampling was conducted from ground surface to the maximum depth of each borehole using a 1.5 m dual tube sampler with disposable PVC liners. The sampler was driven using the direct push method. Disposable nitrile gloves were used during sample collection to minimize the potential for cross-contamination. Soil samples were described in the field by Dillon staff, and observations were recorded in a dedicated field book. Soil samples selected for chemical analysis were stored at a temperature of less than 10°C and handled under chain of custody procedures until received at the laboratory. The soil samples selected for laboratory submission were considered to be representative of worst-case conditions in the boreholes based on field screening results, the location of the APECs, and observations of olfactory and visual characteristics.

Soil samples for VOC analysis, including BTEX and PHC F1, were collected directly into vials containing methanol preservative.

A total of 24 soil samples, including three field duplicates, were submitted to the laboratory for chemical analysis. The soil samples submitted for chemical analysis are summarized in the following table.

Table 2-1 Summary of Soil Samples Submitted for Laboratory Analysis

Sample ID	Depth (mbgs)	Soil Type	Parameters Analyzed
GS1	0.0-0.3	silt, sand and gravel fill	M&I
GS2	0.0-0.3	silt, sand and gravel fill	M&I
18-1a	0.5-1.0	sand and gravel fill	PAHs, M&I
18-1b	3.8-4.3	silt fill	PHCs, BTEX
18-2a	1.4-1.5	silt fill	PAHs, M&I
18-2b	5.2-5.5	silty clay fill	PHCs, BTEX
18-3	3.8-4.0	silty clay fill	PHCs, BTEX
18-4	4.6-4.9	sand and gravel fill	PHCs, BTEX
Dup 3	Field duplicate of 18-4	sand and gravel fill	PHCs, BTEX
18-5a	0.0-0.8	silt, sand and gravel fill	M&I
18-5b	4.3-4.6	silty clay fill	PHCs, VOCs
18-6a	0.0-0.8	silt and sand fill	M&I
18-6b	1.2-1.5	silty clay fill	PHCs, BTEX
18-7	4.6-5.5	silty clay fill	PHCs, VOCs, M&I
18-8	1.5-2.0	silty clay fill	PHCs, VOCs, M&I
18-9	1.5-2.0	silty clay fill	PHCs, VOCs, M&I
18-10	1.0-1.5	silty clay fill	M&I
18-11	0.5-1.0	silty clay fill	M&I
18-12	1.0-1.5	silty clay fill	PHCs, VOCs, PAHs, M&I
18-13	3.9-4.4	silty clay fill	PHCs, VOCs, PAHs, M&I
Dup 1	Field duplicate of 18-13	silty clay fill	PHCs, VOCs, PAHs, M&I
18-14	0.9-1.4	silty clay fill	PHCs, VOCs, PAHs, M&I
Dup 2	Field duplicate of 18-14	silty clay fill	M&I
18-15	0.9-1.1	silt, sand and gravel fill	PHCs, VOCs, PAHs, M&I

Notes:
BTEX = Benzene, toluene, ethylbenzene and xylenes
M&I = Metals and inorganics
PAHs = Polycyclic aromatic hydrocarbons
PHCs = Petroleum hydrocarbons (fractions F1 to F4)
VOCs = Volatile organic compounds

Two composite soil samples were collected, one of the shallow fill soils, and one of the deeper silty clay fill soils. The composite samples were submitted for Toxicity Characteristic Leaching Procedure (TCLP) analysis of ignitability and leachable VOCs, PAHs, metals, and inorganics parameters to determine whether the soils are classified as hazardous or non-hazardous for disposal purposes under *O. Reg. 347*.

2.5 Field Screening Measurements

Soil samples collected from the boreholes were screened for total combustible vapours (TCV) using an RKI Eagle II operated in methane elimination mode and calibrated to 15% LEL hexane.

2.6 Groundwater Monitoring Well Installation

Groundwater monitoring wells were installed by Direct Environmental Drilling personnel. Wells were installed on August 14, 2018, in boreholes 18-4 and 18-7, and on August 15, 2018, in boreholes 18-5, 18-8 and 18-13. Nitrile gloves were used to handle the well casings to minimize the potential for contamination during installation. The wells were installed in accordance with *O. Reg. 903* and were not tagged.

The monitoring wells were screened to intersect the shallow water table based on field observations of the soil conditions during borehole advancement (i.e., elevated moisture and colour change). The wells were constructed using 51 mm Schedule 40 PVC risers and included 1.5 m well screens (slot 10). Sand packs were placed in the annular space within the boreholes around the well screens from the bottom of the wells to approximately 0.3 m above the well screens. Bentonite hole plug seals were placed above the sand packs to ground surface. The wells were completed with flush-mount style protective casings and concreted in place. The monitoring well construction details are shown on the borehole logs in **Appendix A**.

The monitoring wells were equipped with dedicated 1/2-inch LDPE tubing and inertial lift foot valves to facilitate well development. The wells were developed on August 16, 2018, by removing three well volumes of groundwater or by purging the well dry three times. Well 18-7 was dry and was not developed on August 16, 2018.

Purged groundwater was discharged to the ground surface and re-infiltrated into the subsurface. Since no visual or olfactory evidence of contamination was observed in the purged groundwater and the wells were screened in the shallow groundwater table, discharging purged groundwater to the ground surface returned the water to the shallow groundwater system from which it was drawn with no adverse effect on shallow groundwater quality.

2.7 Groundwater Elevations

Groundwater elevations were measured in the monitoring wells on August 16, 2018, prior to well development, on August 17, 2018, prior to sampling, and also on August 28, 2018, during surveying activities. Monitoring well 18-7 was dry on August 16 and 17 and contained water on August 28. Monitoring well BH6 was flooded on August 28 and a water level was not recorded.

2.8 Rising Head (Slug) Tests

Rising head tests were completed on monitoring wells 18-5, 18-8, and 18-13 on August 16, 2018. Water level measurements were recorded using a Solinst M10 Levelogger Junior Edge pressure transducer data logger programmed to record a water level every 0.5 seconds.

2.9 Groundwater: Field Measurement of Water Quality Parameters

A Horiba U-22 multi-parameter flow through cell was used to measure pH, conductivity, dissolved oxygen, redox potential, and temperature in the field during low flow sampling. Measurements obtained prior to sample collection are summarized in **Table 2-2**, below. The remaining measurements are maintained on file.

Table 2-2 Field-measured Water Quality Parameters

Well ID	Appearance/Odour	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)
18-4	silty, brown, no sheen or odour	16.8	7.42	1.51	3.30	-38
18-5	very silty, brown, no sheen or odour	No readings due to silt clogging the sensors				
18-7	dry					
18-8	cloudy, brown, no sheen or odour	14.5	6.99	4.68	5.45	110
18-13	very silty, brown, no sheen or odour	16.0	7.43	1.33	8.04	43
BH6	cloudy, brown, no sheen or odour	12.2	6.92	4.55	5.16	-32

2.10 Groundwater Sampling

Groundwater samples were collected on August 17, 2018. Samples were collected using low-flow sampling methods using CCME Standard Operating Procedure #3 – Low Flow Groundwater Sampling as a guide (CCME, 2016). Dedicated 1/4-inch LDPE tubing and silicone tubing were used to facilitate groundwater purging and sampling with a peristaltic pump. The samples were collected directly into laboratory-supplied bottles and kept according to chain of custody procedures until received at the laboratory.

A total of six groundwater samples, including one blind field duplicate sample, were submitted to the laboratory for chemical analysis, as summarized in the following table.

Table 2-3 Summary of Groundwater Samples Submitted for Laboratory Analysis

Sample ID	Parameters Analyzed	Comments
18-4	PHCs, BTEX	
18-5	PHCs, VOCs, M&I	insufficient volume to analyze PAHs due to lack of recovery in the well
18-10	PHCs, VOCs, M&I	blind field duplicate of 18-5
18-8	PHCs, VOCs, M&I	
18-13	PHC F1, VOCs, M&I	insufficient volume to analyze PHC F2-F4 due to lack of recovery in the well
BH6	PAHs, M&I	

Note that due to slow recovery, monitoring well 18-7 was dry on August 16 and August 17 and was not sampled.

2.11 Analytical Testing

Soil and groundwater samples were submitted to AGAT Laboratories (AGAT) in Mississauga, Ontario for TCLP analysis and analysis of contaminants of concerns including PHCs, VOCs, PAHs, and metals and inorganics. AGAT is certified by the Standards Council of Canada (SCC) and the Canadian Association for Laboratory Accreditation Inc. (CALA).

2.12 Surveying

Ground surface and top of casing elevations of the monitoring wells and borehole locations were surveyed on August 28, 2018, by Dillon personnel. Surveying was conducted using a Trimble R8 GNSS high-precision Global Positioning System (GPS). UTM coordinates are georeferenced to the NAD83 Original coordinate system, zone 17T. The Geodetic Survey of Canada was used as the vertical reference datum. The survey was accurate to +/- 0.01 to 0.02 m horizontal and +/- 0.015 to 0.030 m vertical.

Ground surface elevations and UTM coordinates are provided on the borehole logs in **Appendix A**. Top of casing elevations for the monitoring wells are provided in **Table 1**.

2.13 Quality Assurance and Quality Control Measures

Sample containers were labelled with unique sample identification, the project number, and the sampling date. A laboratory-supplied chain of custody was completed for each laboratory submission; one copy was retained for the project file, while the remaining copy accompanied the samples to the laboratory.

Nitrile gloves, used during sample handling, were replaced after each sample was collected to reduce the potential for cross-contamination of the samples. Field equipment was decontaminated and rinsed with de-ionized water between samples.

Equipment used for field screening of samples including the Horiba U-22 multi-parameter flow through cell and the RKI Eagle II combustible vapour meter were factory-calibrated on August 9, 2018. The RKI Eagle II was calibrated using 15% LEL hexane calibration gas and was operated in methane elimination mode. The Horiba U-22 multi-parameter probe was calibrated using 2-point pH calibration (pH 4.00 and 7.00), 4.49 mS/cm electrical conductivity calibration solution, Sodium Sulfite Zero dissolved oxygen calibration solution, 100 NTU turbidity solution, and 232 mV redox potential calibration solution. Copies of the calibration certificates are maintained on file.

As part of the quality assurance/quality control (QA/QC) program for the project, a minimum of one field duplicate sample for every ten samples was collected and analyzed for each parameter group in both soil and groundwater. The relative percent difference (RPD) between duplicate samples was calculated in accordance with the CCME Guidance Manual for Environmental Site Characterization In Support of Environmental and Human Health Risk Assessment, Volume 1, Table 3-2. The calculated RPD was assessed against the recommended performance criteria of 60% for duplicate soil samples, 40% for duplicate groundwater samples. For parameter concentrations less than five times the detection limit, the difference between the two samples should be less than twice the detection limit to be acceptable.

AGAT also performed QA/QC procedures as outlined in their SCC and CALA procedures. These procedures included analysis of lab duplicates and blanks as well as analysis of surrogate recovery as outlined in the Certificates of Analysis provided in **Appendix B**.

The results of the QA/QC program are provided in **Section 3.7**.

2.14 Monitoring Well Decommissioning

Monitoring wells 18-4, 18-5, 18-7, 18-8, 18-13 and BH6 were decommissioned on October 11, 2018, by Direct Environmental Drilling under the supervision of Dillon field personnel. The wells were decommissioned in accordance with *O. Reg. 903* by removing the well screen and casing, over drilling the borehole to a depth of 1.5 mbgs and backfilling to a depth of 0.15 mbgs with bentonite. Borehole 18-5 was not over drilled due to concerns over the proximity of an underground septic line. The surface of each borehole was finished to match surrounding grades using soil (18-4, 18-5, 18-8, and BH6) or asphalt patch (18-7 and 18-13).

Soil cuttings generated during decommissioning activities were drummed and removed for off-site disposal at APEX Environmental Inc. in Barrie, Ontario on October 16, 2018. Copies of the work order and certificate of destruction are provided in **Appendix F**.

3.0 Review and Evaluation

3.1 Geology

A brief summary of the subsurface conditions encountered at the site is presented below. Detailed borehole logs are included in **Appendix A**.

The site is located on the west breakwater at the entrance to the Welland Canal in Lake Ontario. The breakwater was constructed in the early twentieth century using imported fill and soil dredged from the bottom of the canal. Bathymetric mapping of Lake Ontario indicates that the lake bottom at the site would have been roughly 6 to 8 m below the lake's surface (Elev. 66 to 69 mASL) prior to creation of the breakwater (Virden *et al.*, 1999). The elevation of the ground surface at the site is approximately 78 mASL, therefore 9 to 12 m of fill is estimated to underlie the site. The maximum depth of drilling was 6.1 m; boreholes were terminated within the fill.

The boreholes were advanced through a surface layer of either topsoil, concrete, asphalt or sand and gravel fill. Interbedded layers of silt, silt and sand, and sand and gravel fill were encountered below the surface layer in the majority of boreholes. These layers were variable and discontinuous across the site, extending to depths ranging from 0.4 mbgs to 4.9 mbgs. Silty clay fill was encountered at depth in the majority of the boreholes. The boreholes were terminated in the silty clay fill with the exception of 18-15, which was terminated in sand and gravel fill at a depth of 3.1 mbgs.

Based on water well records in the area, the overburden thickness in the vicinity of the site is estimated to be approximately 15 to 20 m. The underlying bedrock consists of fractured red shale of the Queenston formation. Bedrock was not encountered during drilling activities at the Site, which reached a maximum depth of 6.1 mbgs.

3.2 Hydrogeology

Well records contained in the Ontario Water Wells Database show water wells in the area are installed in the shale bedrock aquifer, roughly 15 to 20 mbgs. The site is located in the Niagara Peninsula Source Protection Area. Source water protection mapping for the area shows the site is not located in a Wellhead Protection Area or a surface water Intake Protection Zone. The site is mapped as a Low Vulnerability Aquifer and is not a Significant Groundwater Recharge Area. The bedrock aquifer is at a low vulnerability to surface impacts due to the thick layers of low permeability soil overlying the bedrock.

3.3 Shallow Groundwater Elevations and Flow

Groundwater levels measured in the monitoring wells on August 28, 2018, are provided in **Table 1**.

Groundwater levels were measured between 2.1 mbgs and 5.7 mbgs, corresponding to elevations ranging from 72.65 mASL to 76.10 mASL. Non-aqueous phase liquids (NAPLs) were not encountered in the monitoring wells.

Shallow groundwater at the site lies within the silty clay fill, which acts as a confining layer. Monitoring wells were screened to intersect the shallow groundwater table based on field observations of moisture, consistency and colour. Groundwater levels measured within the monitoring wells represent the potentiometric surface of the shallow groundwater table in the silty clay fill. Although the potentiometric surface may be higher than the screened interval of the well, this is not anticipated to affect detection of light contaminants such as PHCs and BTEX, which, if present, would sit at the top of the water table.

Groundwater elevations and inferred flow direction in the silty clay are shown in **Figure 4a** and **Figure 4b**. The average water level in Lake Ontario during the month of August 2018, was 74.91 mASL (DFO, 2018). Based on the wide range of groundwater elevations recorded, some of which were below the lake level, it appears that groundwater within many of the wells had not yet reached stable, static levels. Nonetheless, shallow groundwater is inferred to follow the topography of the site, flowing west towards Lake Ontario on the west half of the breakwater, and flowing east towards the Welland Canal on the east half of the breakwater. The breakwater measures roughly 80 m across and juts out 2 km from south to north into Lake Ontario. The existing buildings and infrastructure at the site lie on the east half of the breakwater, where groundwater flow is inferred to be to the east. The majority of the new buildings and infrastructure proposed for the site will also lie on the east half of the breakwater, with the exception of the new septic bed, and a portion of the new garage/utility building, which will be located west of the centreline of the breakwater. Shallow groundwater flow in the vicinity of the new septic bed is therefore anticipated to be to the west towards Lake Ontario. The new potable water well for the site is to be located near the inferred shallow groundwater divide at the centre of the breakwater.

Rising head tests were complete on wells 18-5, 18-8 and 18-13 to assess the hydraulic conductivity of the silty clay. These wells were selected based on location to provide information from three different locations within the proposed construction area. Hydraulic conductivities were calculated using the Hvorslev method. The results are provided in **Appendix C** and summarized in the following table:

Table 3-1 Summary of Rising Head Tests

Monitoring Well ID	Screened Unit	K (m/s)
18-5	silty clay	3.5×10^{-8}
18-8	silty clay	4.4×10^{-9}
18-13	silty clay	3.4×10^{-8} to 8.8×10^{-9}

Overall, the estimated hydraulic conductivity of the silty clay soil ranged from 4.4×10^{-9} m/s to 3.4×10^{-8} m/s. These conductivities are representative of an aquitard condition (rather than an aquifer) and are typical for a silty clay soil.

3.4 Field Screening

The soil field screening results showed low TCV readings (5 ppm or less) in all boreholes and no visual or olfactory evidence of contamination. Field screening results are summarized in the following table and included on the borehole logs in **Appendix A**.

Table 3-2 Summary of Soil Field Screening Results

Borehole ID	Sample Depth (mbgs)	TCV (ppm)	Visual/Olfactory Evidence of Contamination
18-1	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
	4.5-5.3	0	None
	5.3-6.1	0	None
18-2	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
	4.5-5.3	0	None
	5.3-6.1	0	None
18-3	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None

Borehole ID	Sample Depth (mbgs)	TCV (ppm)	Visual/Olfactory Evidence of Contamination
18-4	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
	4.5-5.3	0	None
	5.3-6.1	0	None
18-5	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
	4.5-5.3	0	None
	5.3-6.1	0	None
18-6	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
18-7	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
	4.5-5.3	0	None
	5.3-6.1	0	None
18-8	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
	4.5-5.3	0	None
	5.3-6.1	0	None
18-9	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None

Borehole ID	Sample Depth (mbgs)	TCV (ppm)	Visual/Olfactory Evidence of Contamination
18-10	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
18-11	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
18-12	0.0-0.8	0	None
	0.8-1.5	0	None
18-13	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None
	3.0-3.8	0	None
	3.8-4.5	0	None
	4.5-5.3	0	None
	5.3-6.1	0	None
18-14	0.0-0.8	0	None
	0.8-1.5	0	None
	1.5-2.3	5	None
	2.3-3.0	0	None
18-15	0.0-0.8	5	None
	0.8-1.5	0	None
	1.5-2.3	0	None
	2.3-3.0	0	None

3.5 Soil Quality Results

Laboratory analysis results for the submitted soil samples are summarized in **Tables 2, 3, and 4**. Laboratory Certificates of Analysis are provided in **Appendix B**. Exceedances of the applicable comparison criteria are shown on **Figure 5a** and **Figure 5b.**

Concentrations of PHCs and VOCs in the submitted soil samples were below the laboratory detection limits and also met the applicable comparison criteria.

Concentrations of PAHs, metals and inorganics parameters in the submitted soil samples met the applicable comparison criteria with the exception of the parameters identified in **Table 3-3**.

Table 3-3 Summary of Soil Exceedances

Sample ID	Depth (mbgs)	Parameter	CSQG Tier 1 generic criteria	Concentration (mg/kg)
18-1a	0.5-1.0	IACR[1]	1.0	2.0
GS2	0.0 - 0.3	Lead	140	216
18-8	1.5-2.0	Copper	63	100

Notes:

1. IACR = Index of Additive Cancer Risk (unitless)

For lead and copper, the limiting exposure pathways driving the Tier 1 generic criteria were determined to be applicable at the site. For lead, the limiting pathway is based on human soil ingestion. For copper, the limiting pathway is based on ecological direct soil contact. A Tier 2 evaluation was therefore not completed for these exceedances.

The Index of Additive Cancer Risk (IACR) assesses potential threats to potable groundwater water quality from leaching of carcinogenic PAH mixtures from soil. The IACR exceedance in sample 18-1a is not considered to represent an Area of Environmental Concern (AEC) at the site for the following reasons:

- The IACR exceedance in sample 18-1a occurred at a depth of 0.5 to 1.0 mbgs in the silty sand and gravel fill. Five deeper soil samples collected at the site between 0.9 and 4.9 mbgs in the silty clay fill met the IACR guideline value, indicating the exceedance is limited to the near-surface fill
- If an IACR value were calculated based on the maximum background concentrations of carcinogenic PAH parameters in soil in Ontario (i.e., the Table 1 SCS values), that IACR value would be 9.8 (refer to **Table 3**). Therefore, an IACR value of 2.0 is considered to be a very low level exceedance and is considered to be within the range of provincial background levels
- Potable water at the site is currently sourced from an on-site water well. There is no well record available in the Ontario Water Wells Database for the site water well; however, a review of well records in the vicinity of the site show water wells in the area are installed in the shale bedrock aquifer, roughly 15 to 20 mbgs. The bedrock aquifer is hydraulically isolated from surface by 15 to 20 m of clay overburden, which acts as an aquitard. A new water well will be drilled on-site as part of the proposed construction, this well will presumably be installed in bedrock and appropriately sealed or cased through the overburden soils. The site is located in an area of low vulnerability to the aquifer because of the relatively thick layers of low permeability overburden, which provide some protection to the bedrock aquifer from surface contamination
- Shallow groundwater sampled at nearby monitoring well BH6, located 7 m southwest of borehole 18-1, was analyzed for PAH parameters. PAH concentrations in the groundwater sample were below laboratory detection limits and met the applicable FIGQG and GCDWQ criteria.

Considering these multiple lines of evidence, the risk to potable groundwater within the bedrock aquifer at the site from an IACR of 2.0 at a depth of 0.5-1.0 mbgs is estimated to be very low and this exceedance is not considered to represent an AEC at the site.

In **Table 3**, we note that acenaphthene in sample 18-1a was measured at a concentration of 0.0772 mg/kg. Since there are no Tier 1 generic guidelines specified for acenaphthene under the CSQG, the acenaphthene concentration was compared to the provincial Table 8 SCS. The Table 8 SCS for acenaphthene is 0.072 mg/kg. The limiting pathway driving the Table 8 SCS is based on the protection of freshwater aquatic life. The lowest human health based component value under the Table 8 SCS is the S-GW1 value of 29 mg/kg, which is based on soil leaching to potable groundwater.

Under the CSQG (PAHs Factsheet, 2010, Table 2), there is a pathway-specific soil quality guideline value provided for acenaphthene for the protection of freshwater aquatic life (SQG_{FL}). The SQG_{FL} for acenaphthene in soil is 0.28 mg/kg. With the understanding that federal guidelines should be applied ahead of provincial, it is interpreted that the SQG_{FL} value of 0.28 mg/kg will be protective of ecological receptors at the site and the S-GW1 component value of 29 mg/kg will be protective of human receptors at the site. Therefore, the measured concentration of 0.0772 mg/kg acenaphthene in sample 18-1a is not considered to exceed the applicable guidelines.

3.5.1 Soil Characterization for Disposal Purposes

Based on the analytical results of the TCLP analyses, the reported concentrations were below the applicable *O.Reg. 558* Table 4 Leachate Quality Criteria for the analyses conducted. The results of TCLP analysis indicate that the soil on the site can be considered non-hazardous. Excess soil removed from the site may be disposed of at a facility licensed to accept contaminated, non-hazardous waste.

The TCLP analysis results are provided on the Laboratory Certificates of Analysis in **Appendix B**.

3.6 Groundwater Quality Results

Laboratory analysis results for the submitted groundwater samples are summarized in **Tables 5 and 6**. Laboratory Certificates of Analysis are provided in **Appendix B**. Exceedances of the applicable FIGQG, CWQG, GCDWQ MACs, and/or Table 8 SCS (in the absence of federal guidelines) are shown on **Figure 6a** and **Figure 6b**.

Concentrations of PAHs, PHCs and VOCs in the submitted groundwater samples were below the laboratory detection limits and also met the applicable CWQG, FIGQG, GCDWQ MACs, and the Table 8 SCS (for parameters without federal guidelines).

Concentrations of the following metals parameters exceeded the FIGQG (or Table 8 SCS in the absence of federal guidelines) as well as the background Table 1 SCS values in one or more monitoring wells on-site:

Table 3-4 Summary of Groundwater Exceedances

Sample ID	Parameter	FIGQG	Concentration (mg/kg)
18-5 / 18-10[a]	Cobalt	3.8[b]	5.7 / 5.7
	Lead	1	2.5 / <0.5
18-8	Aluminum	100	470
	Cobalt	3.8[b]	5.8
	Copper	2	13.7
	Iron	300	565
	Lead	1	2.8
	Uranium	15	17.4
18-13	Aluminum	100	447
	Copper	2	5.8
	Iron	300	525
BH6	Cobalt	3.8[b]	9.7
	Iron	300	3010

Notes:

a. 18-10 is a blind field duplicate of 18-5.

b. No FIGQG guideline available, value is based on the Table 8 SCS.

For each of the above-noted parameters (except cobalt, which was assessed using the Table 8 SCS), the Tier 1 generic criteria are driven by the protection of freshwater aquatic life exposure pathway, which is an applicable pathway at the site; therefore, a Tier 2 evaluation was not completed.

3.6.1 Comparison to Guidelines for Canadian Drinking Water Quality

As noted above, groundwater quality in the submitted samples met the GCDWQ human-health based MAC values. For additional information, groundwater analytical results were also compared to the Aesthetic Objectives (AO) and Operational Guidelines (OG) set out in the GCDWQ. Three parameters exceeded the AO or OG in one or more monitoring wells, as follows:

- Aluminum – concentrations measured in 18-8 (470 µg/L) and 18-13 (447 µg/L) exceeded the OG of 100 µg/L. The OG applies to treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum found in groundwater. These exceedances do not represent an environmental concern for the site
- Iron – concentrations measured in 18-8 (565 µg/L) and 18-13 (525 µg/L) and BH6 (3010 µg/L) exceeded the AO of 300 µg/L. The AO is based on taste and staining of laundry and plumbing fixtures; no evidence exists of dietary iron toxicity in the general population. These exceedances do not represent an environmental concern for the site
- Chloride – concentrations measured in duplicate samples collected at monitoring well 18-5 (378 µg/L and 369 µg/L) exceeded the AO of 120 µg/L. The AO is based on taste and potential for corrosion in distribution systems. The exceedances do not represent an environmental concern for the site.

Groundwater samples were collected from shallow overburden monitoring wells installed in the silty clay fill and are not considered a drinking water resource. Comparison to GCDWQ was completed for due diligence as an additional line of evidence.

3.7 Quality Assurance and Quality Control Results

Overall, the QA/QC measures implemented during this investigation did not identify concerns with equipment function or calibration, cross-contamination, laboratory analyses, sample integrity or other concerns. The data obtained from the investigation is considered reliable, representative, and suitable for interpretation.

3.7.1 Soil

Three field duplicate soil samples were submitted for analysis as follows:

- Dup 1 was collected as a duplicate of 18-13 and submitted for analysis of PHCs, VOCs, PAHs, metals, and inorganics
- Dup 2 was collected as a duplicate of 18-14 and submitted for analysis of metals and inorganics
- Dup 3 was collected as a duplicate of 18-4 and submitted for analysis of PHCs and BTEX.

The calculated RPDs were assessed against the recommended performance criteria (RPD < 60%).

The results indicated acceptable correlation between the samples with the exception of electrical conductivity (EC) and sodium adsorption ratio (SAR) in duplicate samples 18-13 and Dup 1, where the calculated RPDs were 76% and 90% for EC and SAR, respectively. Given that the concentrations of EC and SAR were below the applicable CSQG Tier 1 generic criteria in both duplicate samples, it can be concluded with a reasonable level of confidence that EC and SAR at this location met the applicable federal criteria despite some variability.

3.7.2 Groundwater

One field duplicate groundwater sample (18-10) was collected from monitoring well 18-5 and submitted for the same analyses as the original sample. The calculated RPDs were assessed against the recommended performance criteria (RPD < 40%). The results indicated acceptable correlation between the samples with the exception of aluminum, where the calculated RPD was 146%. Given that the aluminum concentration was below the applicable CWQG Tier 1 generic criteria and the CDWQG in both duplicate samples, it can be concluded with a reasonable level of confidence that the concentration of aluminum in groundwater at this location met the applicable federal criteria despite some variability.

Groundwater analytical results for VOC parameters showed concentrations to be below the laboratory detection limits and also below the applicable CSQG Tier 1 guidelines and the GCDWQ in all of the submitted groundwater samples. Cross-contamination of the groundwater VOCs samples was therefore not suspected.

AGAT also carried out internal QA/QC measures including process recoveries, blanks, and replicate samples. The laboratory QA/QC results are provided on the Certificates of Analysis in **Appendix B**. The results were acceptable and therefore suitable for interpretation.

3.8 Evaluation and Interpretation of Results

Four APECs were investigated through the soil and groundwater assessment at the site. The investigation did not identify contamination associated with APEC 2 (Fuel Storage and Handling) or APEC 3 (Possible Petroleum Contaminated Soil).

The investigation of APEC 1 (Importation of Fill Material of Unknown Quality) confirmed the presence of metal impacted soil and groundwater above applicable criteria. The metal impacted fill is identified as AEC 1 and described as follows:

- AEC 1: Metal-Impacted Fill - A soil sample collected from borehole 18-8, north of the hoop house, contained copper at a concentration of 100 mg/kg, exceeding the federal guideline of 63 mg/kg. The sample was collected at a depth of 1.5-2.0 mbgs in the silty clay fill, which is inferred to be the source of the exceedance. Concentrations of aluminum, cobalt, copper, iron, lead and uranium exceeded the applicable FIGQG (or Table 8 SCS) and provincial background concentrations in groundwater samples collected from monitoring wells 18-5, 18-8, 18-13, and/or BH6. The wells are screened within the silty clay fill at a depth of 4.5 mbgs to 6.1 mbgs. The exceedances are based on the protection of freshwater aquatic life exposure pathway. The source of the metals exceedances in soil and groundwater is believed to be from naturally-occurring minerals in the silty clay fill, which was reportedly dredged from the bottom of the canal and imported to the site to create the breakwater in the early 1900s. The silty clay fill is present across the entire site and is estimated to extend to a depth of between 9 and 12 mbgs. Horizontal and vertical extents of the soil and groundwater impacts associated with AEC 1 have not been delineated.

The investigation of APEC 4 (Metals Impacts to Shallow Soil) confirmed the presence of lead impacts in soil above applicable criteria. The lead-impacted soil is identified as AEC 4 and described as follows:

- AEC 4: Lead Impacts to Shallow Soil - A shallow soil sample (GS2) collected from the east side of the lightkeeper's residence contained lead at a concentration of 216 mg/kg, exceeding the federal guideline of 140 mg/kg. The sample was collected at a depth of 0.0-0.3 mbgs in silty sand and gravel fill. The source of the lead exceedance is inferred to be due to flaking of lead based exterior paint on the lightkeeper's residence. Horizontal and vertical extents of the lead-impacted soil area have not been delineated.

4.0 Conceptual Site Model

The site is located on the west breakwater at the entrance to the Welland Canal in St. Catharines, Ontario. The breakwater was constructed in the early twentieth century using dredged material from the canal and imported fill. The west breakwater juts out roughly 2 km from south to north into Lake Ontario and measures roughly 80 m across (east-west). Soils at the site consist of shallow discontinuous and variable layers of sand, silt and gravel fill underlain by silty clay fill to a depth of 9 to 12 mbgs followed by native silty clay. The overburden is estimated to be 15 to 20 m thick in the vicinity of the site, overlying fractured shale bedrock. Potable groundwater wells in area are installed in the fractured shale bedrock aquifer. The shale bedrock aquifer is considered to have a low vulnerability to surface impacts due to the relatively thick layer of low permeability overburden.

Shallow groundwater monitoring wells installed as part of this investigation are screened at a depth of 4.5 to 6.1 mbgs in the silty clay fill. The hydraulic conductivity of the silty clay fill is very low, on the order of 10^{-8} to 10^{-9} m/s. Shallow groundwater within the monitoring wells was measured between 2.06 mbgs and 5.67 mbgs (Elev. 76.10 to 72.65 mASL). Given the very low hydraulic conductivity of the soil, the groundwater levels measured in the monitoring wells on August 28, 2018, (13 days after well installation) are not representative of static water levels. The mean monthly water level in Lake Ontario for the month of August 2018 was 74.91 mASL (DFO, 2018). The static level of the shallow groundwater table should be higher than the lake level.

Shallow groundwater flow is estimated to follow the topography of the site. On the east half of the breakwater, shallow groundwater is inferred to flow to the east towards the Welland Canal. On the west half of the breakwater, shallow groundwater is inferred to flow to the west towards Lake Ontario. A shallow groundwater divide is inferred to exist along the centreline of the breakwater.

Analytical results for the soil and groundwater samples submitted as part of this assessment identified three AECs, as follows:

- AEC 1: Metal-Impacted Fill: A soil sample collected from borehole 18-8, north of the hoop house, contained copper at a concentration of 100 mg/kg, exceeding the federal guideline of 63 mg/kg. The sample was collected at a depth of 1.5-2.0 mbgs in the silty clay fill, which is inferred to be the source of the exceedance. Concentrations of aluminum, cobalt, copper, iron, lead and uranium exceeded the applicable FIGQG (or Table 8 SCS) and provincial background concentrations in groundwater samples collected from monitoring wells 18-5, 18-8, 18-13, and/or BH6. The wells are screened within the silty clay fill at a depth of 4.5 mbgs to 6.1 mbgs. The exceedances are based on the protection of freshwater aquatic life exposure pathway. The source of the metals exceedances is believed to be from naturally-occurring minerals in the silty clay fill, which was reportedly dredged from the bottom of the canal and imported to the site to create the breakwater in the early 1900s. The silty clay fill is present across the entire site and is estimated to extend to a depth of between 9 and 12 mbgs. Horizontal and vertical extents of the soil and groundwater impacts associated with AEC 1 have not been delineated
- AEC 4: Lead Impacts to Shallow Soil - A shallow soil sample (GS2) collected from the east side of the lightkeeper's residence contained lead at a concentration of 216 mg/kg, exceeding the federal guideline of 140 mg/kg. The sample was collected at a depth of 0.0-0.3 mbgs in silty sand and gravel fill. The source of the lead exceedance is inferred to be due to flaking of lead based exterior paint on the lightkeeper's residence. Horizontal and vertical extents of the lead-impacted soil area have not been delineated.

The proposed construction activities at the site will include demolition of some existing structures and subsurface infrastructure, construction of new buildings, and installation of new underground services including a new potable water well, new septic system, and associated underground piping. Buildings are to be slab on grade construction with no basements. The contaminants identified through the soil and groundwater assessment are not considered a concern for indoor air quality. Shallow soil and groundwater contaminants are also not considered to be a concern for drinking water quality, assuming water is sourced from a bedrock well and the well is properly sealed through the overburden soils.

Of the contaminants that were identified on-site, only the shallow soil exceedance for lead is considered to be a potential human health concern for site residents. The Tier 1 federal guideline for lead is based on human soil ingestion by the most sensitive receptors, which, for residential land use, are infants, children up to six years of age, and fetuses (i.e., pregnant women). The site operates as a CCG SAR station. Infants and children are not present on the site and access to the site is restricted by a fence and locked gate; however, adults, which may include pregnant women, reside at the site, therefore this potential receptor/exposure pathway may be applicable.

For construction workers and other site visitors who do not reside on-site, the concentration of lead in soil can be compared to the CSQG Tier 1 generic criterion for commercial land use, which is 260 mg/kg.

The concentration of lead in sample GS2 is below this criterion and therefore the concentration of lead in the soil is not considered a human health risk for site workers who do not reside on-site.

The lead exceedance was identified in shallow soil on the east side of the lightkeeper's residence. The lightkeeper's residence and the grass and flower beds along its east side are to be retained during construction. A small walkway will be paved to the front entrance.

The potential receptors and exposure pathways for the contaminants are as follows:

- Human Receptors: site workers, site residents (adult)
  - Incidental soil ingestion
  - Direct soil contact
  - Dust inhalation
- Ecological Receptors: plants, invertebrates, birds and terrestrial animals
  - Direct soil contact
  - Soil and food ingestion
- Ecological Receptors: freshwater aquatic life (through groundwater to surface water migration)
  - Direct contact
  - Ingestion.

A pictorial representation of the contaminants, receptors and exposure pathways identified at the site is included as **Figure 7**.

5.0 Recommendations

Based on the results of the Soil and Groundwater Assessment, the following recommendations are provided for your consideration:

5.1 Construction-Related Recommendations

- The contaminated soil on site should not be reused on the site
- Soil generated through excavation during the construction should be disposed of at a facility licensed to accept non-hazardous waste. A receiving site should be identified by the contractor
- Clean backfill is required and should be tested
- Methods should be implemented to ensure that recontamination of the clean backfill does not occur (ex., installing a geotextile liner)
- Methods should be implemented to ensure that contamination is not spread at the site
- Decontamination measures should be implemented when working with the contaminated media
- The contractor should implement mitigation measures to prevent contamination of the site from lead-based paints and other potentially contaminating materials during demolition and construction activities
- The new well to be drilled as part of the construction project must be installed in the bedrock aquifer and sealed through the overburden fill and soils
- If construction dewatering is required, further characterization of the groundwater may be required depending on how the excess groundwater is managed
  - The contractor will need to determine the volume of water they expect to generate during dewatering in order to determine whether the water can be managed on-site or whether it will need to be hauled off-site for disposal
  - If volumes are minimal, groundwater pumped from excavations can be placed in holding tanks on-site and tested to ensure water quality is suitable for discharge to ground surface
  - If, based on anticipated volumes or other considerations, the contractor decides that groundwater should be removed by vac truck for off-site disposal, the contractor will need to identify a receiver for the groundwater (e.g., licensed treatment facility, municipal sewer). Additional testing may be required by the receiver
  - In Ontario, a provincial Permit to Take Water (PTTW) is required for construction dewatering over 50,000 L/day under Section 34 of the *Ontario Water Resources Act*. Since the site is federally-owned, a PTTW is not required; however, if water takings are anticipated to exceed 50,000 L/day, the construction manager may recommend that the contractor obtain a PTTW to be consistent with provincial regulations.

5.2 Management-Related Recommendations

- For the reasons provided within this report, no further investigation of the soil exceedance for IACR is recommended
- Surface water quality in the Welland Canal and Lake Ontario should be tested to determine whether the water quality meets the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life for metals parameters including aluminium, cobalt, copper, iron, lead, and uranium, which were found to exceed the FIGQG in one or more shallow groundwater monitoring wells on the site. The FIGQG values that were exceeded are based on the migration of groundwater to surface water and exposure of freshwater aquatic life receptors
- Further delineation of copper and lead exceedances in soil (AEC 1 and AEC 4) should be completed. Following delineation, a Risk Management/Remedial Options Evaluation should be completed
- Lead based exterior paint on site structures should be inspected annually and maintained in good condition to prevent contamination of shallow soils at the site from flaking paint.

6.0 Conclusions

Overall, the assessment has characterized the soil and groundwater conditions at the site within the proposed construction area. The assessment achieved five of the seven objectives, including:

- The absence or presence of AECs was confirmed in relevant media of concern within the construction area
- The nature and level of contaminants for AECs was characterized within the construction area
- Detailed soil, geological, hydrogeological and hydrological conditions were identified on the site
- A conceptual site model was developed
- Recommendations for managing/remediating contaminated soil and/or groundwater during the construction were provided.

The following two objectives were not achieved:

- Complete delineation of the AECs in all affected media
- Determine the area and/or volume of the contaminated media.

Delineation of contaminants in soil and groundwater is an iterative process, requiring successive intrusive investigations to collect additional soil and groundwater samples to delineate exceedances. Estimates of area/volume of contaminated media could not be provided without horizontal and vertical delineation.

TCLP analysis results show that the soil on the site can be considered non-hazardous. Excess soil removed from the site during construction may be disposed of at a facility licensed to accept contaminated, non-hazardous waste.

Based on the analytical results for the soil and groundwater samples submitted as part of the assessment, two AECs were identified within the construction area. The AECs are summarized in the following table:

Table 6-1 Summary of Areas of Environmental Concern

AEC	Name	Source	Contaminant Exceedances	Extent of Impacted Media
AEC 1	Metal-Impacted Impacted Fill	Unknown, but believed to be primarily from naturally-occurring minerals in the silty clay fill, which was dredged from the bottom of the canal and placed at the site to create the breakwater in the early 1900s.	Soil Soil sample 18-8, collected in the silty clay fill at a depth of 1.5-2.0 mbgs, contained 100 mg/kg of copper, exceeding the federal guideline of 63 mg/kg. Groundwater Aluminum, cobalt, copper, iron, lead and uranium exceeded the applicable federal guidelines and provincial background concentrations in one or more of the shallow monitoring wells on-site. The exceedances are based on the protection of freshwater aquatic life exposure pathway.	Soil The copper impacts are estimated to be relatively localized, given that 16 other soil samples from across the site were submitted for copper analysis and all of them met the applicable guideline. Partial horizontal delineation of the copper-impacted fill has been established to the south (by sample 18-2a) and west (by sample 18-9). Vertical delineation has not been established. Groundwater The horizontal and vertical extents of metals exceedances in groundwater have not been delineated. All four of the wells that were sampled contained exceedances. The wells are screened within the silty clay fill at a depth of 4.5 -6.1 mbgs. The silty clay fill was used to construct the breakwater and is present across the entire site extending to an estimated depth of 9 to 12 mbgs.
AEC 4	Lead Impacts to Shallow Soil	Historical flaking lead-based paint on the lightkeeper's residence.	Shallow soil sample GS2 contained lead at a concentration of 216 mg/kg, exceeding the federal guideline of 140 mg/kg.	GS2 was collected at a depth of 0.0-0.3 mbgs in the silty sand and gravel fill soil on the east side of the former lightkeeper's residence. Horizontal and vertical extents of the lead-impacted soil area have not been delineated.

7.0 Limitations

This report was prepared exclusively for the purposes, project and site location outlined in the report. The report is based on information provided to, or obtained by Dillon as indicated in the report, and applies solely to site conditions existing at the time of the site investigation. Although a reasonable investigation was conducted by Dillon, Dillon's investigation was by no means exhaustive and cannot be construed as a certification of the absence of any contaminants from the site. Rather, Dillon's report represents a reasonable review of available information within an agreed work scope, schedule, and budget. It is therefore possible that currently unrecognized contamination or potentially hazardous materials may exist at the site, and that the levels of contamination or hazardous materials may vary across the site. Further review and updating of the report may be required as local and site conditions, and the regulatory and planning frameworks, change over time.

This report was prepared by Dillon for the sole benefit of the Government of Canada. The material in the report reflects Dillon's best judgment in light of the information available to Dillon at the time of preparation. Any use which a third party (i.e., a party other than our Client) makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

8.0 Closure

We trust that the information provided herein is sufficient for your needs. Please contact the undersigned if you have any questions or comments or require additional information.

DILLON CONSULTING LIMITED
LONDON, ONTARIO

Rachel Bryan, M.A.Sc., P.Eng.
Environmental Engineer

Darin Burr, P.Geo.
Senior Hydrogeololgist

9.0 References

Aqua Terre Solutions Inc. 2009. CCME Phase I/II Environmental Site Assessment, Search and Rescue Station, Port Weller, Ontario. February 11, 2009.

Canadian Environmental Quality Guidelines (CEQG) (CCME, 1999; updated and available online at http://st-ts.ccme.ca/en/index)

CCME 2006. A protocol for the derivation of environmental and human health soil quality guidelines (update). Canadian Council of Ministers of the Environment, Winnipeg.

CCME 2007. Ecological Risk Assessment Guidance for Contaminated Sites (Draft). (Available online at https://www.ccme.ca/files/ERA%20Guidance_e_draft.pdf)

CCME's Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment, Volumes 1 to 4 (2016).

CCME's Subsurface Assessment Handbook for Contaminated Sites, 1994 (CCME catalogue: http://www.ccme.ca/files/Resources/csm/pn_1144_e.pdf)

CH2M HILL Canada Limited. 2003. Fuel Storage Tank Assessment and Upgrades Report, Port Weller Search and Rescue (SAR), Port Weller, Ontario. March 31, 2003.

Conor Pacific Environmental Technologies Inc. 1998. Phase 1 Environmental Site Assessment, Port Weller Outer Light L.L. 543, Welland Canal, Lake Ontario. March 1998.

CSA Z769-00 Standard, Phase II Environmental Site Assessment (R2013).

DFO 2018. Water Levels, Great Lakes and Montreal Harbour. Monthly Bulletin Prepared by the Canadian Hydrographic Service, Department of Fisheries and Oceans. August 2018.

DST Consulting Engineers Inc. (DST). 2010. Compliance Audit of Storage Tank Systems, Port Weller Search and Rescue (SAR) Station, Government Road, Saint Catharines, Ontario. March 2010.

DST. 2018. Project-Specific Designated Substances Survey, Search and Rescue Station, Port Weller, Ontario. February 1, 2018.

Englobe Corp. 2018a. Search and Rescue Station (SAR) Revitalization, St. Catharine, Ontario, Final Geotechnical Investigation Report. January 2, 2018.

Englobe Corp. 2018b. Welland Canals Parkway, St. Catharines, Ontario, Update Phase I Environmental Site Assessment Report. March 29, 2018.

Federal Interim Groundwater Quality Guidelines (FIGQG) for Federal Contaminated Sites (FCSAP, revised June 2016).

Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada, revised February 2017)

Jaques Whitford Limited. 2007. Environmental Compliance Audit – Port Weller Search and Rescue Station, Port Weller, Ontario. November 15, 2007.

Ministry of Environment, Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario, April 15, 2011.

Ministry of the Environment, Soil Groundwater and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*, April 15, 2011.

Niagara Peninsula Source Protection Area website: http://www.sourceprotection-niagara.ca/

SNC-Lavalin Environment. 2011. Completion of Tank System Upgrade Program, Port Weller Search and Rescue Station, Government Road, St. Catharines, Ontario. September 2011.

Virden, W.T., J.S. Warren, T.L. Holcombe, D.F. Reid, and T.L. Berggren, 1999, Bathymetry of Lake Ontario, National Geophysical Data Center, World Data Center for Marine Geology and Geophysics, Boulder, CO, Report MGG-15, scale 1:275,000 poster.

XCG Consultants Ltd. 2016. Storage Tank System Hardware Compliance Program, Welland Canals Parkway, Port Weller, Ontario. March 31, 2016.

XCG Consultants Ltd. 2017. Storage Tank System Upgrades, Government Road, Welland Canals Parkway, Concession 1, Township of Grantham, Port Weller, Ontario. March 22, 2017.

Tables

Table 1: Groundwater Elevations
Soil and Groundwater Assessment
Port Weller Search and Rescue Station

Monitoring Well ID	UTM Coordinates		Ground Surface Elevation	Top of Casing Elevation	Depth to Groundwater		Groundwater Elevation (masl)
					(mbtoc)	(mbgs)	
	Easting (m)	Northing (m)	(masl)	(masl)	28-Aug-18	28-Aug-18	28-Aug-18
18-4	4788611	644627	78.01	77.823	3.06	3.25	74.76
18-5	4788624	644622	78.22	78.152	4.60	4.67	73.55
18-7	4788643	644616	78.32	78.147	5.50	5.67	72.65
18-8	4788643	644603	78.16	78.051	1.95	2.06	76.10
18-13	4788674	644619	78.07	77.962	4.73	4.84	73.23
BH6[1]	4788588	644601	78.25	78.132	Flooded	Flooded	Flooded

Notes:

masl = metres above sea level

mbgs = metres below ground surface

mbtoc = metres below top of casing

1. BH6 installed by Englobe in 2017

Table 2 - Soil Analytical Results: PHCs and VOCs
Soil and Groundwater Assessment
Port Weller Search and Rescue Station

			Sample ID:	18-1b	18-2b	18-3	18-4	Dup 3		18-5b	18-6b	18-7	18-8	18-9	18-12	18-13	Dup 1		18-14	18-15
			Sample Depth (mbgs):	3.8-4.3	5.2-5.5	3.8-4.0	4.6-4.9			4.3-4.6	1.2-1.5	4.6-5.5	1.5-2.0	1.5-2.0	1.0-1.5	3.9-4.4			0.9-1.4	0.9-1.1
			Date:	15-Aug-18	15-Aug-18	15-Aug-18	14-Aug-18	Field		14-Aug-18	15-Aug-18	14-Aug-18	14-Aug-18	15-Aug-18	15-Aug-18	14-Aug-18	Field		14-Aug-18	14-Aug-18
Parameter	**Units**	**CCME Tier 1 Criteria[a,b]**	**Table 8 SCS[c]**					Duplicate of 18-4	RPD (%)								Duplicate of 18-13	RPD (%)		
Petroleum Hydrocarbons (PHCs)																				
PHC F1 (C6-C10)	mg/kg	170		<5	<5	<5	<5	<5	0	<5	<5	<5	<5	<5	<5	<5	<5	0	<5	<5
PHC F2 (C10-C16)	mg/kg	150		<10	<10	<10	<10	<10	0	<10	<10	<10	<10	<10	<10	<10	<10	0	<10	<10
PHC F3 (C16 to C34)	mg/kg	1300		<50	<50	<50	<50	<50	0	<50	<50	<50	<50	<50	<50	<50	<50	0	<50	<50
PHC F4 (C34 to C50)	mg/kg	5600		<50	<50	<50	<50	<50	0	<50	<50	<50	<50	<50	<50	<50	<50	0	<50	<50
Volatile Organic Compounds (VOCs)																				
Dichlorodifluoromethane	mg/kg	nv	0.05	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	<0.005	<0.005
Vinyl Chloride	mg/kg	nv	0.02	-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Bromomethane	mg/kg	nv	0.05	-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Trichlorofluoromethane	mg/kg	nv	0.25	-	-	-	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0	<0.004	<0.004
Acetone	mg/kg	nv	0.5	-	-	-	-	-	-	<0.130	-	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	0	<0.130	<0.130
1,1-Dichloroethylene	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Methylene Chloride	mg/kg	5		-	-	-	-	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0	<0.003	<0.003
trans-1,2-Dichloroethylene	mg/kg	nv	0.05	-	-	-	-	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0	<0.003	<0.003
cis-1,2-Dichloroethylene	mg/kg	nv	0.05	-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,2-Dichloroethylene (cis + trans)	mg/kg	5		-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	<0.005	<0.005
Methyl tert-butyl Ether	mg/kg	nv	0.05	-	-	-	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0	<0.004	<0.004
1,1-Dichloroethane	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Methyl Ethyl Ketone	mg/kg	nv	0.5	-	-	-	-	-	-	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0	<0.10	<0.10
Chloroform	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,2- Dichloroethane	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,1,1-Trichloroethane	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Carbon Tetrachloride	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Benzene	mg/kg	0.0068		<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,2-Dichloropropane	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Trichloroethylene	mg/kg	0.01		-	-	-	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0	<0.004	<0.004
Bromodichloromethane	mg/kg	nv	0.05	-	-	-	-	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0	<0.003	<0.003
cis-1,3-Dichloropropene	mg/kg	nv	nv	-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Methyl Isobutyl Ketone	mg/kg	nv	0.5	-	-	-	-	-	-	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0	<0.10	<0.10
trans-1,3-Dichloropropene	mg/kg	nv	nv	-	-	-	-	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0	<0.003	<0.003
1,1,2-Trichloroethane	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Toluene	mg/kg	0.08		<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Dibromochloromethane	mg/kg	nv	0.05	-	-	-	-	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0	<0.003	<0.003
Ethylene Dibromide	mg/kg	nv	0.05	-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Tetrachloroethylene	mg/kg	0.2		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,1,1,2-Tetrachloroethane	mg/kg	nv	0.05	-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Chlorobenzene	mg/kg	1		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Ethylbenzene	mg/kg	0.018		<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
m & p-Xylene	mg/kg	nv	nv	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Bromoform	mg/kg	nv	0.05	-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
Styrene	mg/kg	5		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,1,2,2- Tetrachloroethane	mg/kg	5		-	-	-	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0	<0.004	<0.004
o-Xylene	mg/kg	nv	nv	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,3-Dichlorobenzene	mg/kg	1		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,4-Dichlorobenzene	mg/kg	1		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,2-Dichlorobenzene	mg/kg	1		-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,2,4-Trichlorobenzene	mg/kg	2		-	-	-	-	-	-	<0.007	-	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	0	<0.007	<0.007
Xylene Mixture (Total)	mg/kg	2.4		<0.004	<0.004	<0.004	<0.004	<0.004	0	<0.002	<0.004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
1,3-Dichloropropene (Cis + Trans)	mg/kg	nv	0.05	-	-	-	-	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0	<0.002	<0.002
n-Hexane	mg/kg	6.5		-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0	<0.005	<0.005

Notes:

Parameter Concentration Exceeds Applicable Criteria

nv = no value derived

a. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Tier 1 generic guidelines, residential land use, fine textured soils.

b. Canada-Wide Standard for Petroleum Hydrocarbons (PHCs) in Soil, 2008. Tier 1 generic criteria, residnetial land use, fine-grained surface soils.

c. Table 8: Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Groundwater Condition, Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use set out in *Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act* (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.

Table 3 - Soil Analytical Results: PAHs
Soil and Groundwater Assessment
Port Weller Search and Rescue Station

							Sample ID:	18-1a	18-2a	18-12	18-13	Dup 1		18-14	18-15
							Sample Depth (mbgs):	0.5-1.0	1.4-1.5	1.0-1.5	3.9-4.4	Field Duplicate of 18-13	RPD (%)	0.9-1.4	0.9-1.1
							Date:	15-Aug-18	15-Aug-18	15-Aug-18	14-Aug-18			14-Aug-18	14-Aug-18
Parameter	**Units**	**SQG_{HH}[a]**	**SQG_{EH}[b]**	**Table 8 SCS[c]**	**Table 1 SCS[d]**	**SQG_{FL}[e]**	**Provincial Human Health Guideline Value[f]**								
Carcinogenic PAHs															
Benzo(a)anthracene	mg/kg	nv	1		0.36			0.13	<0.01	<0.01	<0.01	<0.01	0%	<0.01	0.01
Benzo(a)pyrene	mg/kg	nv	20		0.3			0.11	<0.01	<0.01	<0.01	<0.01	0%	<0.01	0.01
Benzo(b)fluoranthene	mg/kg	nv	1		0.47			0.07	<0.05	<0.05	<0.05	<0.05	0%	<0.05	<0.05
Benzo(b+j)fluoranthene	mg/kg	nv	nv	nv	nv	nv	nv	0.14	<0.1	<0.1	<0.1	<0.1	0%	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	nv	nv	0.68	0.68			0.07	<0.01	<0.01	<0.01	<0.01	0%	<0.01	0.02
Benzo(k)fluoranthene	mg/kg	nv	1		0.48			0.04	<0.01	<0.01	<0.01	<0.01	0%	<0.01	<0.01
Benzo(b+j+k)fluoranthene	mg/kg	nv	1		nv		nv	0.18	<0.11	<0.11	<0.11	<0.11	0%	<0.11	<0.11
Chrysene	mg/kg	nv	nv	2.8	2.8			0.14	<0.01	<0.01	<0.01	<0.01	0%	<0.01	0.02
Dibenzo(a,h)anthracene	mg/kg	nv	1		0.1			0.012	<0.006	<0.006	<0.006	<0.006	0%	<0.006	<0.006
Indeno(1,2,3)pyrene	mg/kg	nv	1		0.23			0.06	<0.01	<0.01	<0.01	<0.01	0%	<0.01	<0.01
B(a)P TPE	mg/kg	5.3[g]	nv		0.59[i]			0.16	0.01	0.01	0.01	0.01	0%	0.01	0.02
IACR	unitless	1.0[h]	nv		9.8[i]			**2.0**	0.4	0.4	0.4	0.4	0%	0.4	0.4
Non-Carcinogenic PAHs															
Acenaphthene	mg/kg	nv	nv	0.072	0.072	0.28	29[j]	0.0772	<0.00671	<0.00671	<0.00671	<0.00671	0%	<0.00671	<0.00671
Acenaphthylene	mg/kg	nv	nv	0.093				<0.004	<0.004	<0.004	<0.004	<0.004	0%	<0.004	0.005
Anthracene	mg/kg	nv	2.5				5400[k]	0.09	<0.03	<0.03	<0.03	<0.03	0%	<0.03	<0.03
Fluoranthene	mg/kg	nv	50				7.8[k]	0.32	<0.05	<0.05	<0.05	<0.05	0%	<0.05	<0.05
Fluorene	mg/kg	nv	nv	0.19				0.05	<0.01	<0.01	<0.01	<0.01	0%	<0.01	<0.01
Naphthalene	mg/kg	nv	0.013				4.6[l]	0.01	<0.01	<0.01	<0.01	<0.01	0%	<0.01	<0.01
Phenanthrene	mg/kg	nv	0.046		0.69		24[j]	0.48	<0.03	<0.03	<0.03	<0.03	0%	<0.03	<0.03
Pyrene	mg/kg	nv	10				78[k]	0.33	<0.05	<0.05	<0.05	<0.05	0%	<0.05	<0.05

Notes:

Value Exceeds Applicable Criteria

nv = no value derived

B(a)P TPE = Benzo(a)pyrene Total Potency Equivalents

IACR = Index of Additive Cancer Risk

a. Canadian Soil Quality Guidelines for the Protection of Human Health (SQG_{HH}), residential land use.

b. Canadian Soil Quality Guidelines for the Protection of Environmental Health (SQG_{EH}), residential land use.

c. Table 8: Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Groundwater Condition, Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use set out in *Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act* (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.

d. Table 1: Full Depth Background Site Condition Standards, Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use, set out in *Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act* (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.

e. Canadian Soil Quality Guideline for the Protection of Freshwater Aquatic Life (SQG_{FL})

f. Value represents the minimum human health based soil component value for the Table 8 SCS, set out in *Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario,* dated April 15, 2011.

g. Human health based soil quality guideline for direct contact (SQG_{DH}) based on an incremental lifetime cancer risk of 1 in 100,000.

h. Soil quality guideline for the protection of potable drinking water (SQG_{PW}).

i. Calculated based on provincial background concentrations from Table 1 SCS for carcinogenic PAH parameters.

k. Based on human direct contact.

j. Based on soil leaching to potable groundwater.

l. Based on indoor air quality.

Table 4 - Soil Analytical Results: Metals and Inorganics
Soil and Groundwater Assessment
Port Weller Search and Rescue Station

Sample ID:				GS1	GS2	18-1a	18-2a	18-5a	18-6a	18-7	18-8	18-9	18-10	18-11	18-12	18-13	Dup 1		18-14	Dup 2		18-15
Sample Depth (mbgs):				0.0-0.3	0.0-0.3	0.5-1.0	1.4-1.5	0.0-0.8	0.0-0.8	4.6-5.5	1.5-2.0	1.5-2.0	1.0-1.5	0.5-1.0	1.0-1.5	3.9-4.4	Field Duplicate of 18-13		0.9-1.4	Field Duplicate of 18-14		0.9-1.1
Date:				17-Aug-18	17-Aug-18	15-Aug-18	15-Aug-18	14-Aug-18	15-Aug-18	14-Aug-18	14-Aug-18	15-Aug-18	15-Aug-18	15-Aug-18	15-Aug-18	14-Aug-18			14-Aug-18			14-Aug-18
Parameter	**Units**	**CCME Tier 1 Criteria[a]**	**Table 1 SCS[b]**															RPD (%)			RPD (%)	
Metals and Inorganics																						
Antimony	mg/kg	20		<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	0%	<0.8	<0.8	0%	<0.8
Arsenic	mg/kg	12		6	9	7	4	5	5	5	5	5	5	2	4	11	12	9%	4	4	0%	9
Barium	mg/kg	500		83	63	70	123	48	67	123	144	111	141	62	129	59	70	17%	125	153	20%	22
Beryllium	mg/kg	4		0.6	0.6	0.8	0.6	<0.5	0.6	0.9	0.7	1.0	0.7	0.9	0.9	0.8	0.8	0%	1.1	1.0	10%	0.8
Cadmium	mg/kg	10		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0%	<0.5	<0.5	0%	<0.5
Chromium	mg/kg	64		17	23	23	17	16	25	26	19	24	22	23	26	15	18	18%	30	34	13%	21
Cobalt	mg/kg	50		8.4	11.2	11.5	9.8	6.4	8.3	13.6	11.9	13.5	12.6	11.9	14.0	13.5	13.3	1%	14.8	15.0	1%	14.3
Copper	mg/kg	63[c]	92	35	36	31	17	18	22	27	**100**	26	18	6	26	46	34	30%	27	26	4%	35
Lead	mg/kg	140[d]	120	54	**216**	27	28	51	83	10	8	11	13	5	10	6	6	0%	11	11	0%	10
Molybdenum	mg/kg	10		<0.5	<0.5	<0.5	0.7	1	<0.5	<0.5	0.5	<0.5	0.8	1.7	<0.5	<0.5	<0.5	0%	<0.5	<0.5	0%	<0.5
Nickel	mg/kg	45		17	21	25	22	13	18	30	24	29	28	30	30	27	27	0%	34	34	0%	28
Selenium	mg/kg	1		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	<0.4	0.5	<0.4	<0.4	<0.4	<0.4	0.4	0%	0.6	<0.4	<2RDL	<0.4
Silver	mg/kg	20		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	0%	<0.2	<0.2	0%	<0.2
Thallium	mg/kg	1		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0%	<0.4	<0.4	0%	<0.4
Tin	mg/kg	50		1	2	1	1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	0%	<1	<1	0%	<1
Uranium	mg/kg	23		0.6	0.7	<0.5	<0.5	0.5	<0.5	0.7	0.7	0.7	0.6	0.6	0.8	<0.5	0.5	0%	0.8	0.8	0%	<0.5
Vanadium	mg/kg	130		23	23	23	20	16	21	35	28	33	27	21	34	17	22	26%	39	45	14%	19
Zinc	mg/kg	250		119	186	74	67	77	110	68	55	65	65	59	64	56	61	9%	74	68	8%	131
Chromium VI	mg/kg	0.4		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0%	<0.2	<0.2	0%	<0.2
Cyanide	mg/kg	0.9		<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0%	<0.040	<0.040	0%	<0.040
Mercury	mg/kg	6.6		0.30	1.51	<0.10	0.17	3.25	5.51	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0%	<0.10	<0.10	0%	<0.10
Electrical Conductivity	mS/cm	2		0.211	0.151	0.162	0.193	0.277	0.259	1.120	0.491	0.201	0.219	0.142	0.285	0.152	0.337	76%	0.941	0.671	33%	0.121
Sodium Adsorption Ratio	unitless	5		0.203	0.228	0.163	0.718	0.129	0.465	0.873	0.607	0.220	0.439	0.263	1.300	0.673	1.770	90%	0.374	0.461	21%	0.207
pH	pH Units	6 to 8		7.47	7.45	7.42	7.52	7.27	7.29	7.52	7.55	7.54	7.50	7.23	7.47	7.57	7.69	2%	7.58	7.70	2%	7.59

Notes:

Value Exceeds Applicable Guideline

nv = no value

a. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Tier 1 generic criteria, residential land use, fine textured soils.

b. Table 1: Full Depth Background Site Condition Standards, Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use set out in *Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act* (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.

c. Limiting Pathway: Ecological soil contact. This pathway is applicable at the site and therefore a Tier 2 evaluation was not completed.

d. Limiting Pathway: Human soil ingestion. This pathway is applicable at the site and therefore a Tier 2 evaluation was not completed.

Table 5
Groundwater Analytical Results: Wells Located Within 10 m of a Surface Water Body
Soil and Groundwater Assessment
Port Weller Search and Rescue Station

						Sample ID:	18-4
						Date:	17-Aug-18
Parameter	**Units**	**CWQG[a]**	**FIGQG[b]**	**Table 8 SCS[c]**	**GCDWQ[d]**		
					Value	**Type[e]**	
Petroleum Hydrocarbons (PHCs)							
PHC F1 (C6-C10)	µg/L	nv	6500				<25
PHC F2 (C10-C16)	µg/L	nv	1800				<100
PHC F3 (C16 to C34)	µg/L	nv	nv	500			<100
PHC F4 (C34 to C50)	µg/L	nv	nv	500			<100
Volatile Organic Compounds (VOCs)							
Benzene	µg/L	370			5	MAC	<0.20
Toluene	µg/L	2.0			60 | 24	MAC | AO	<0.20
Ethylbenzene	µg/L	90			140 | 1.6	MAC | AO	<0.10
Xylene Mixture	µg/L	nv	21000		90 | 20	MAC | AO	<0.20

Notes:

Value Exceeds the Applicable Criteria

nv = no value

a. Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater)

b. Federal Interim Groundwater Quality Guidelines (2016), Tier 1 generic criteria, residnetial land use, fine textured soils.

c. Table 8: Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Groundwater Condition, All Types of Property Use set out in *Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act* (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.

d. Guidelines for Canadian Drinking Water Quality, February 2017.

e. MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective; OG = Operational Guideline

Table 6
Groundwater Analytical Results: Wells Located >10 m from a Surface Water Body
Soil and Groundwater Assessment
Port Weller Search and Rescue Station

						Sample ID:	18-5	18-10		18-8	18-13	BH6
						Date:	17-Aug-18	17-Aug-18		17-Aug-18	17-Aug-18	17-Aug-18
Parameter	**Units**	**FIGQG Tier 1 Criteria[a]**	**Table 8 SCS[b]**	**Table 1 SCS[c]**	**GCDWQ[d] Value**	**GCDWQ[d] Type[e]**		Field Duplicate of 18-5	RPD (%)			
Petroleum Hydrocarbons (PHCs)												
PHC F1 (C6-C10)	µg/L	6500					<25	<25	0	<25	<25	-
PHC F2 (C10-C16)	µg/L	1800					<100	<100	0	<100	-	-
PHC F3 (C16 to C34)	µg/L	nv	500				<100	<100	0	<100	-	-
PHC F4 (C34 to C50)	µg/L	nv	500				<100	<100	0	<100	-	-
Volatile Organic Compounds (VOCs)												
Dichlorodifluoromethane	µg/L	nv	590				<0.40	<0.40	0	<2.00	<0.40	-
Vinyl Chloride	µg/L	18			2	MAC	<0.34	<0.34	0	<1.70	<0.34	-
Bromomethane	µg/L	56					<0.40	<0.40	0	<2.00	<0.40	-
Trichlorofluoromethane	µg/L	nv	150				<0.80	<0.80	0	<4.00	<0.80	-
Acetone	µg/L	13000					<2.0	<2.0	0	<10.0	<2.0	-
1,1-Dichloroethylene	µg/L	680			14	MAC	<0.60	<0.60	0	<3.00	<0.60	-
Methylene Chloride	µg/L	98			50	MAC	<0.60	<0.60	0	<3.00	<0.60	-
trans- 1,2-Dichloroethylen	µg/L	17					<0.40	<0.40	0	<2.00	<0.40	-
Methyl tert-butyl ether	µg/L	5000			15	AO	<0.40	<0.40	0	<2.00	<0.40	-
1,1-Dichloroethane	µg/L	3100					<0.60	<0.60	0	<3.00	<0.60	-
Methyl Ethyl Ketone	µg/L	150000					<2.0	<2.0	0	<10.0	<2.0	-
cis- 1,2-Dichloroethylene	µg/L	17					<0.40	<0.40	0	<2.00	<0.40	-
Chloroform	µg/L	1.8					<0.40	<0.40	0	<1.80	<0.40	-
1,2-Dichloroethane	µg/L	100			5	MAC	<0.40	<0.40	0	<2.00	<0.40	-
1,1,1-Trichloroethane	µg/L	1100					<0.60	<0.60	0	<3.00	<0.60	-
Carbon Tetrachloride	µg/L	11			2	MAC	<0.40	<0.40	0	<2.00	<0.40	-
Benzene	µg/L	2800			5	MAC	<0.40	<0.40	0	<2.00	<0.40	-
1,2-Dichloropropane	µg/L	140					<0.40	<0.40	0	<2.00	<0.40	-
Trichloroethylene	µg/L	270			5	MAC	<0.40	<0.40	0	<2.00	<0.40	-
Bromodichloromethane	µg/L	8500					<0.40	<0.40	0	<2.00	<0.40	-
Methyl Isobutyl Ketone	µg/L	58000					<2.0	<2.0	0	<10.0	<2.0	-
1,1,2-Trichloroethane	µg/L	30					<0.40	<0.40	0	<2.00	<0.40	-
Toluene	µg/L	82000			60 | 24	MAC | AO	<0.40	<0.40	0	<2.00	<0.40	-
Dibromochloromethane	µg/L	26000					<0.20	<0.20	0	<1.00	<0.20	-
Ethylene Dibromide	µg/L	0.83					<0.20	<0.20	0	<1.00	<0.20	-
Tetrachloroethylene	µg/L	110			10	MAC	<0.40	<0.40	0	<2.00	<0.40	-
1,1,1,2-Tetrachloroethane	µg/L	28					<0.20	<0.20	0	<1.00	<0.20	-
Chlorobenzene	µg/L	1.3			80 | 30	MAC | AO	<0.20	<0.20	0	<1.00	<0.20	-
Ethylbenzene	µg/L	42000			140 | 1.6	MAC | AO	<0.20	<0.20	0	<1.00	<0.20	-
m & p-Xylene	µg/L	nv	nv				<0.40	<0.40	0	<2.00	<0.40	-
Bromoform	µg/L	770					<0.20	<0.20	0	<1.00	<0.20	-
Styrene	µg/L	72					<0.20	<0.20	0	<1.00	<0.20	-
1,1,2,2-Tetrachloroethane	µg/L	15					<0.20	<0.20	0	<1.00	<0.20	-
o-Xylene	µg/L	nv	nv				<0.20	<0.20	0	<1.00	<0.20	-
1,3-Dichlorobenzene	µg/L	42					<0.20	<0.20	0	<1.00	<0.20	-
1,4-Dichlorobenzene	µg/L	26			5 | 1	MAC | AO	<0.20	<0.20	0	<1.00	<0.20	-
1,2-Dichlorobenzene	µg/L	0.7			200 | 3	MAC | AO	<0.20	<0.20	0	<0.70	<0.20	-
1,3-Dichloropropene	µg/L	45					<0.60	<0.60	0	<3.00	<0.60	-
Xylene Mixture	µg/L	21000			90 | 20	MAC | AO	<0.40	<0.40	0	<2.00	<0.40	-
n-Hexane	µg/L	nv	51				<0.40	<0.40	0	<2.00	<0.40	-
Trihalomethanes[f]	µg/L	nv	nv		100	MAC	<1.2	<1.2	0	<5.8	<1.2	-

Notes:
Value Exceeds Applicable Criteria and Table 1 SCS
nv = no value derived
a. Federal Interim Groundwater Quality Guidelines (2016), Tier 1 generic criteria, residnetial land use, fine textured soils.
b. Table 8: Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Groundwater Condition, All Types of Property Use set out in Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.
c. Table 1: Full Depth Background Site Condition Standards, All Types of Property Use, set out in Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.
d. Guidelines for Canadian Drinking Water Quality, February 2017.
e. MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective; OG = Operational Guideline
f. Trihalomethanes refers to the total of chlorodibromomethane, chloroform, bromodichloromethane and bromoform.
g. Limiting Exposure Pathway: Freshwater Aquatic Life. This pathway is applicable at the site and therefore a Tier 2 evaluation was not completed.

Table 6
Groundwater Analytical Results: Wells Located >10 m from a Surface Water Body
Soil and Groundwater Assessment
Port Weller Search and Rescue Station

						Sample ID:	18-5	18-10		18-8	18-13	BH6
						Date:	17-Aug-18	17-Aug-18		17-Aug-18	17-Aug-18	17-Aug-18
Parameter	**Units**	**FIGQG Tier 1 Criteria[a]**	**Table 8 SCS[b]**	**Table 1 SCS[c]**	**GCDWQ[d] Value**	**GCDWQ[d] Type[e]**		Field Duplicate of 18-5	RPD (%)			
Polycyclic Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	µg/L	nv	nv				-	-	-	-	-	<0.01
2-Methylnaphthalene	µg/L	nv	nv				-	-	-	-	-	<0.01
1- and 2-Methylnaphthale	µg/L	180					-	-	-	-	-	<0.02
Acenaphthene	µg/L	5.8					-	-	-	-	-	<0.01
Acenaphthylene	µg/L	46					-	-	-	-	-	<0.01
Acridine	µg/L	0.05					-	-	-	-	-	<0.01
Anthracene	µg/L	0.012					-	-	-	-	-	<0.012
Benzo(a)anthracene	µg/L	0.018					-	-	-	-	-	<0.018
Benzo(a)pyrene	µg/L	0.01			0.04	MAC	-	-	-	-	-	<0.010
Benzo(b)fluoranthene	µg/L	0.48					-	-	-	-	-	<0.01
Benzo(ghi)perylene	µg/L	0.21					-	-	-	-	-	<0.01
Benzo(k)fluoranthene	µg/L	0.48					-	-	-	-	-	<0.01
Chrysene	µg/L	0.1					-	-	-	-	-	<0.01
Dibenzo(a,h)anthracene	µg/L	0.28					-	-	-	-	-	<0.01
Fluoranthene	µg/L	0.04					-	-	-	-	-	<0.01
Fluorene	µg/L	3					-	-	-	-	-	<0.01
Indeno(1,2,3-cd)pyrene	µg/L	0.23					-	-	-	-	-	<0.01
Naphthalene	µg/L	1.1					-	-	-	-	-	<0.01
Phenanthrene	µg/L	0.4					-	-	-	-	-	<0.01
Pyrene	µg/L	0.025					-	-	-	-	-	<0.01
Quinoline	µg/L	3.4					-	-	-	-	-	<0.01
Metals and Inorganics												
Aluminum	µg/L	100[g]		nv	100	OG	77.6	12	146%	**470**	**447**	12
Antimony	µg/L	2000			6	MAC	<1.0	<1.0	0%	<1.0	<1.0	<1.0
Arsenic	µg/L	5			10	MAC	2	1.8	11%	1.1	<1.0	1.5
Barium	µg/L	500			1000	MAC	111	123	10%	42.3	35.4	23.1
Beryllium	µg/L	5.3					<0.5	<0.5	0%	<0.5	<0.5	<0.5
Boron	µg/L	1500			5000	MAC	465	469	1%	237	253	333
Cadmium	µg/L	0.09		0.5	5	MAC	0.051	0.023	76%	0.130	0.047	0.027
Chromium	µg/L	8.9			50	MAC	4	4	0%	2.5	<2.0	3.4
Cobalt	µg/L	nv	3.8				**5.7**	**5.7**	0%	**5.8**	3.2	**9.7**
Copper	µg/L	2[g]		5	1000	AO	4.4	3.7	17%	**13.7**	**5.8**	2.9
Iron	µg/L	300[g]		nv	300	AO	95.3	<10.0	>2RDL	**565**	**525**	**3010**
Lead	µg/L	1[g]		1.9	10	MAC	**2.5**	<0.5	>2RDL	**2.8**	<0.5	<0.5
Mercury	µg/L	0.026			1	MAC	<0.02	<0.02	0%	<0.02	-	<0.02
Molybdenum	µg/L	73					5.8	6.1	5%	0.9	12.3	0.7
Nickel	µg/L	25					3.6	3.1	15%	9.5	5.2	3.8
Selenium	µg/L	1		5	50	MAC	1.1	1.2	9%	<1.0	<1.0	<1.0
Silver	µg/L	0.25					<0.2	<0.2	0%	<0.2	<0.2	<0.2
Thallium	µg/L	0.8					<0.3	<0.3	0%	<0.3	<0.3	<0.3
Uranium	µg/L	15[g]		8.9	20	MAC	11.9	12.8	7%	**17.4**	5.8	14.8
Vanadium	µg/L	nv	6.2				1.1	1.2	9%	1.8	1.9	0.7
Zinc	µg/L	10		160	5000	AO	20.3	19.3	5%	119	11.0	12.9
Chromium VI	µg/L	nv	25				<1	<1	0%	<1	-	<1
Cyanide	µg/L	1		5	200	MAC	<2	<2	0%	<2	<2	<2
Chloride	mg/L	120		790	250	AO	378	369	2%	162	99.9	193
pH	pH Units	6.5 to 9			7.0 to 10.5	OG	7.74	7.75	0%	7.59	7.99	7.71

Notes:

Value Exceeds Applicable Criteria and Table 1 SCS

nv = no value derived

a. Federal Interim Groundwater Quality Guidelines (2016), Tier 1 generic criteria, residnetial land use, fine textured soils.

b. Table 8: Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Groundwater Condition, All Types of Property Use set out in Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.

c. Table 1: Full Depth Background Site Condition Standards, All Types of Property Use, set out in Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act (April 15, 2011). Applicable in the Province of Ontario under O. Reg. 153/04.

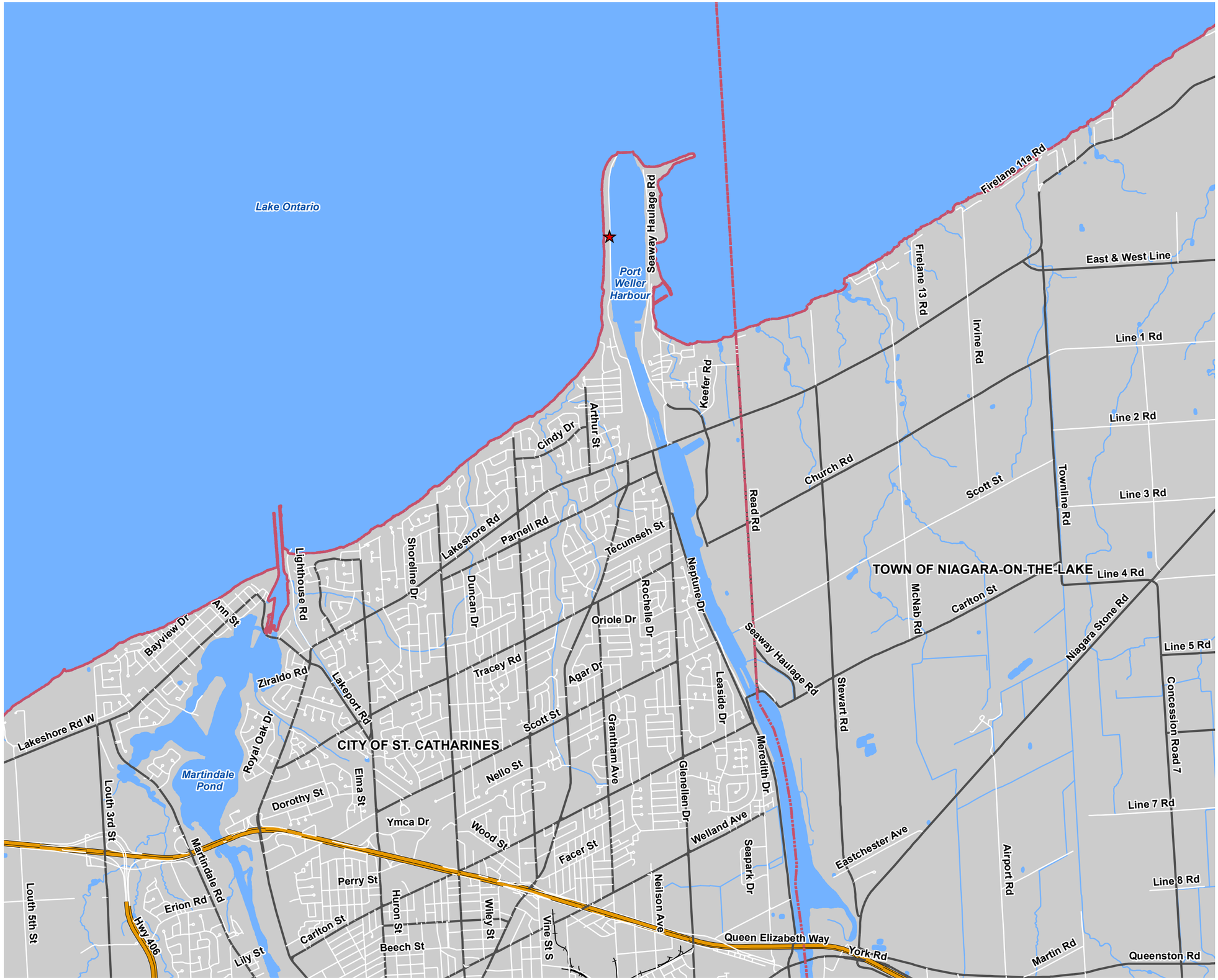
d. Guidelines for Canadian Drinking Water Quality, February 2017.

e. MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective; OG = Operational Guideline

f. Trihalomethanes refers to the total of chlorodibromomethane, chloroform, bromodichloromethane and bromoform.

g. Limiting Exposure Pathway: Freshwater Aquatic Life. This pathway is applicable at the site and therefore a Tier 2 evaluation was not completed.

Figures



PUBLIC SERVICES AND PROCUREMENT CANADA

SOIL AND GROUNDWATER ASSESSMENT
4 WELLAND CANALS PARKWAY
ST. CATHERINES, ONTARIO

SITE LOCATION

FIGURE 1

- Site Location
- Freeway
- Major Road
- Minor Road
- Railway
- Watercourse
- Waterbody
- Lower and Single Tier Municipal Boundary

0 200 400 800 Meters

SCALE 1:40,000

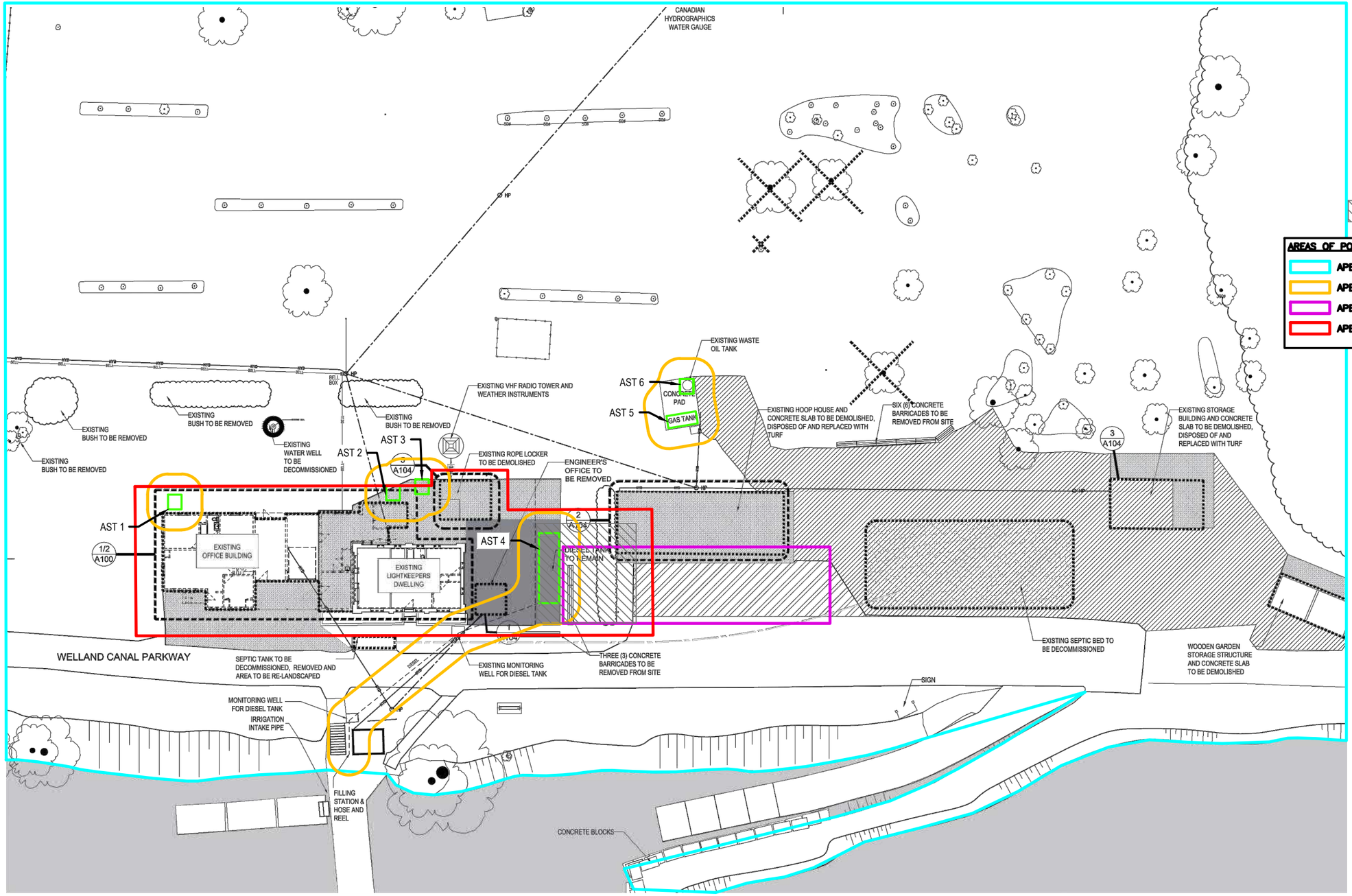
MAP DRAWING INFORMATION:
DATA PROVIDED BY CANVEC, MNRF

MAP CREATED BY: TLA
MAP CHECKED BY: RB
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 18-8083
STATUS: DRAFT
DATE: 9/4/2018

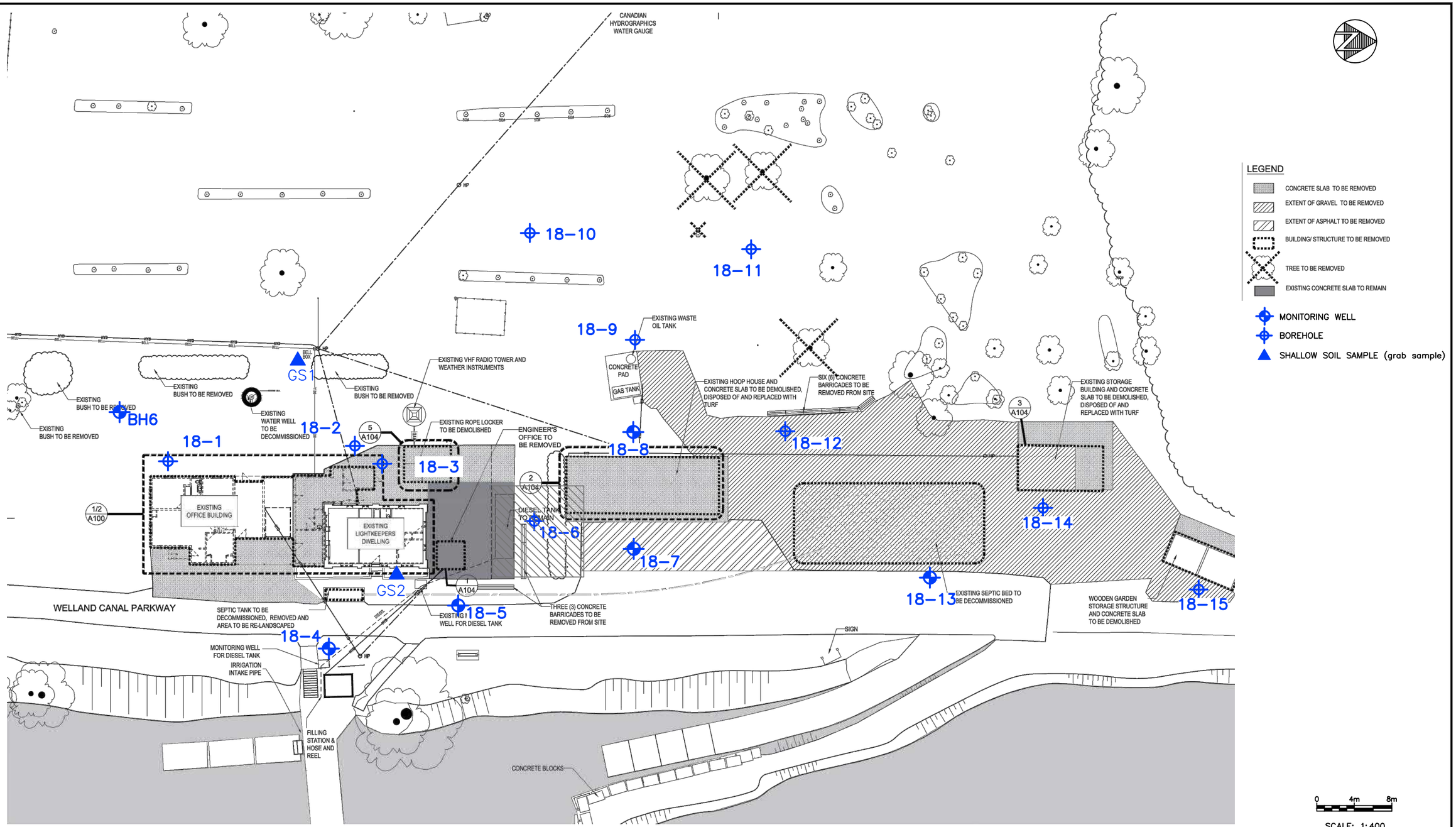
FILE LOCATION: G:\GIS\188083 Port Weller\MXD\F1_SiteLocation.mxd



Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: November 2018	TITLE: AREAS OF POTENTIAL ENVIRONMENTAL CONCERN	FIGURE NO.: 2

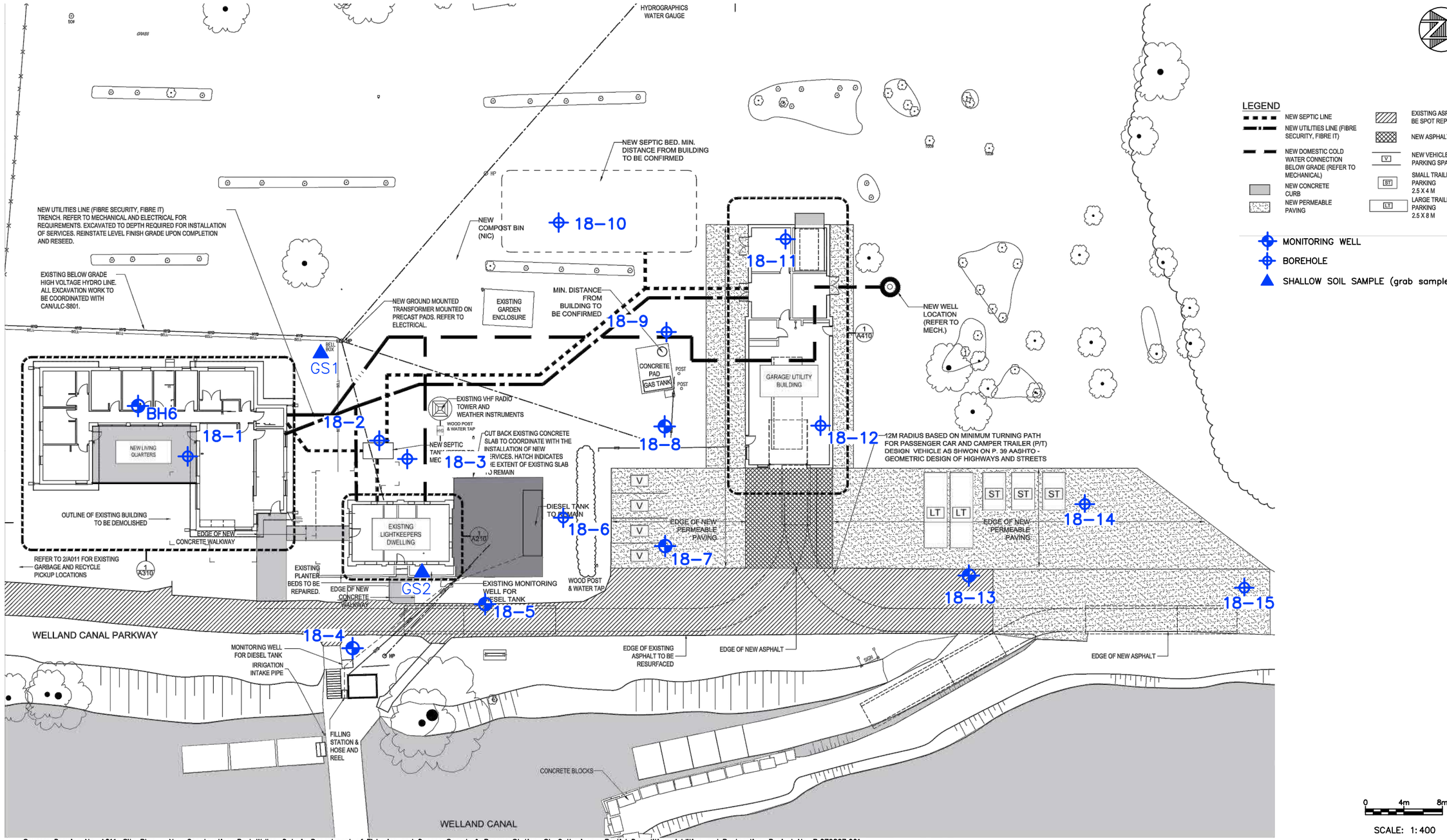
FileName:c:\projectwise\working directory\projects 2018\10\rebl\dms35138\figures 2 and 3 - apecs and site plans.dwg



Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: October 2018	TITLE: SITE PLAN - DEMOLITION	FIGURE NO.: 3a

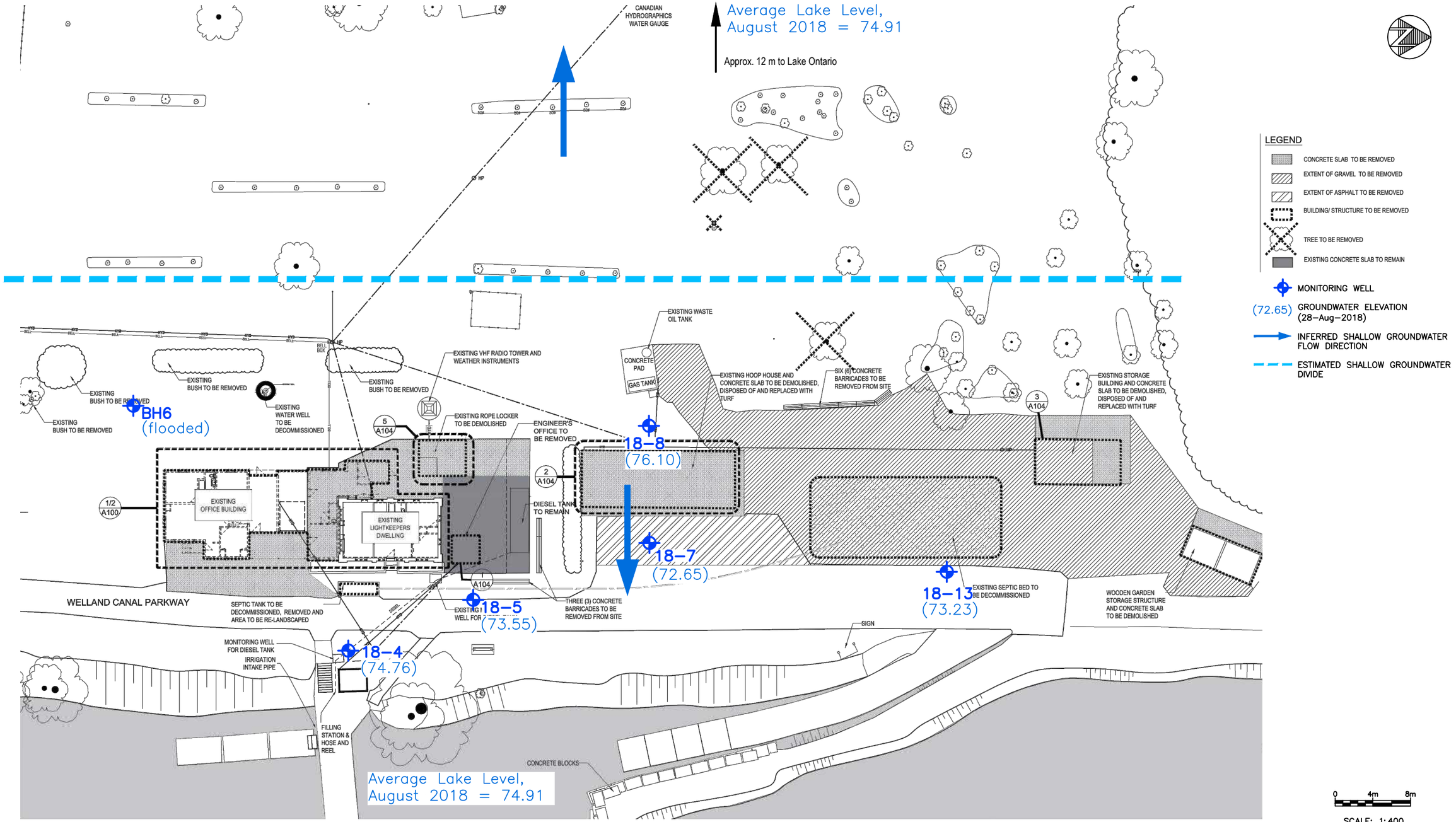
FileName:c:\projectwise\working directory\projects 2018\10\rebl\dms351381figures 2, 3 and 4 - site plans.dwg



Source: Drawing No. A011, Site Plan – New Construction, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: October 2018	TITLE: SITE PLAN - NEW CONSTRUCTION	FIGURE NO.: 3b

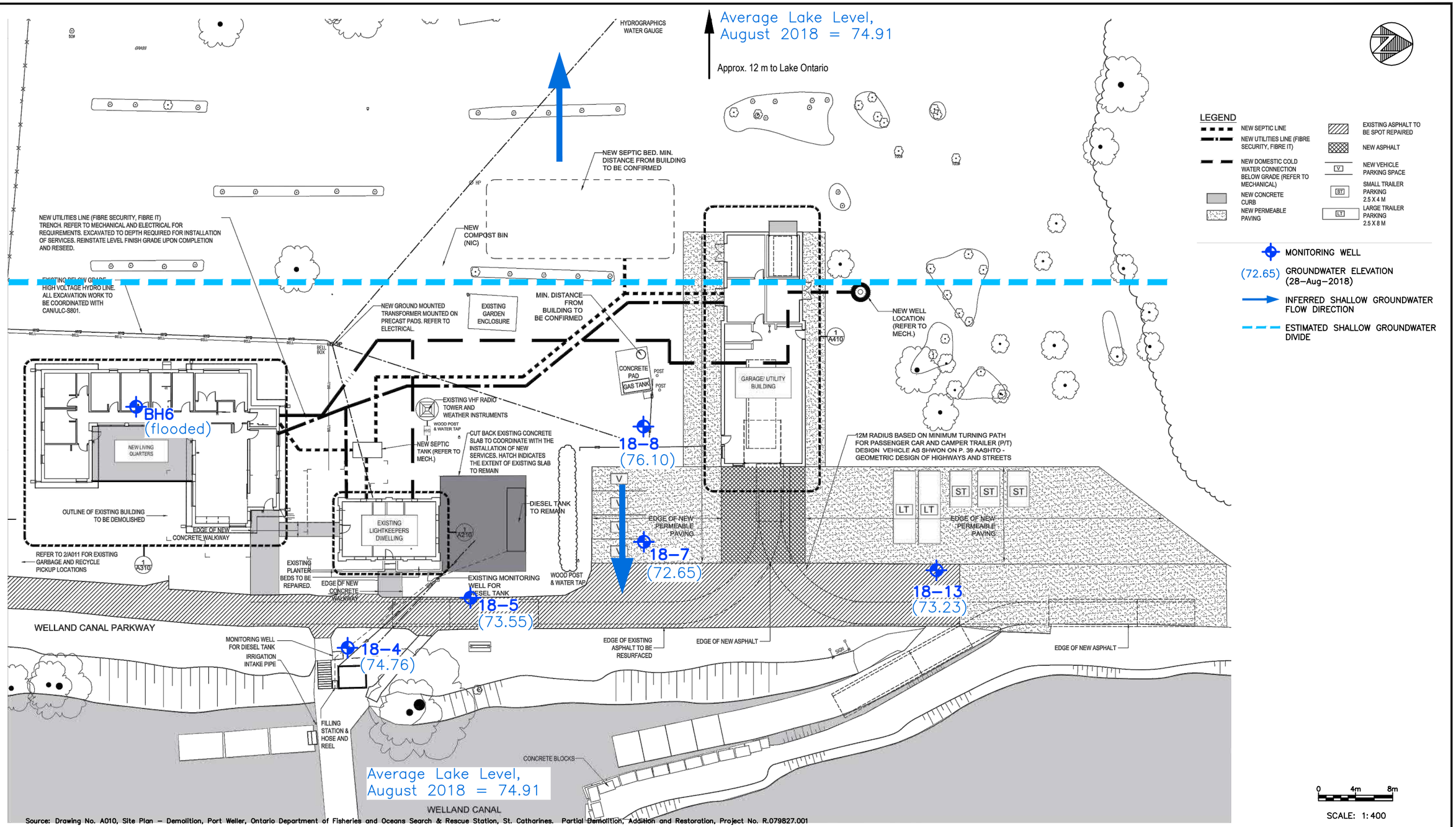
FileName:c:\projectwise\working directory\projects 2018\10\ebdms35138\figures 2, 3 and 4 - site plans.dwg



Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: October 2018	TITLE: GROUNDWATER ELEVATIONS AND FLOW - DEMOLITION	FIGURE NO.: 4a

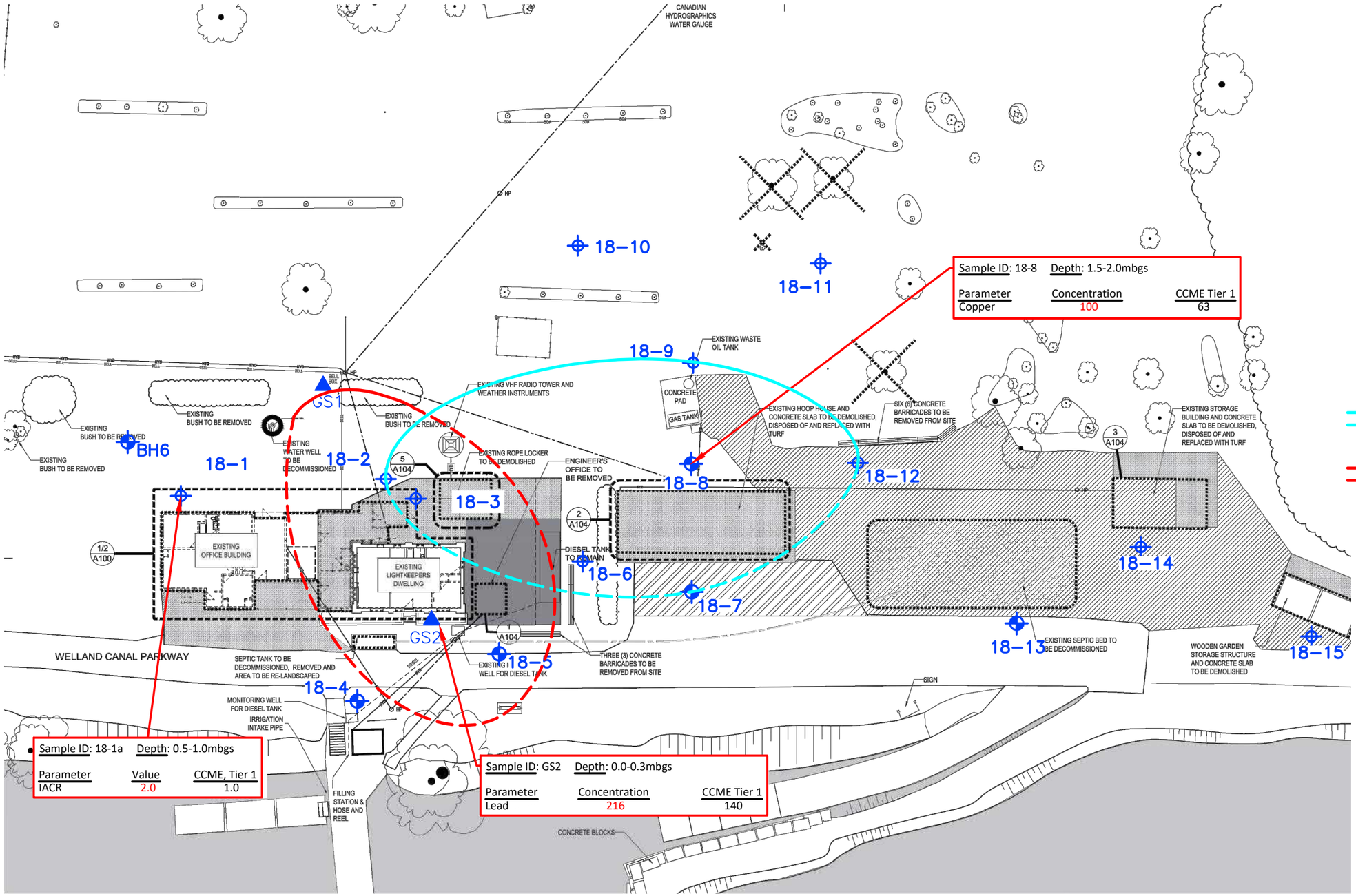
FileName:c:\projectwise\working directory\projects 2018\10\rebl\dms35138\figure 4 - gw elevations.dwg



Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: October 2018	TITLE: GROUNDWATER ELEVATIONS AND FLOW - NEW CONSTRUCTION	FIGURE NO.: 4b

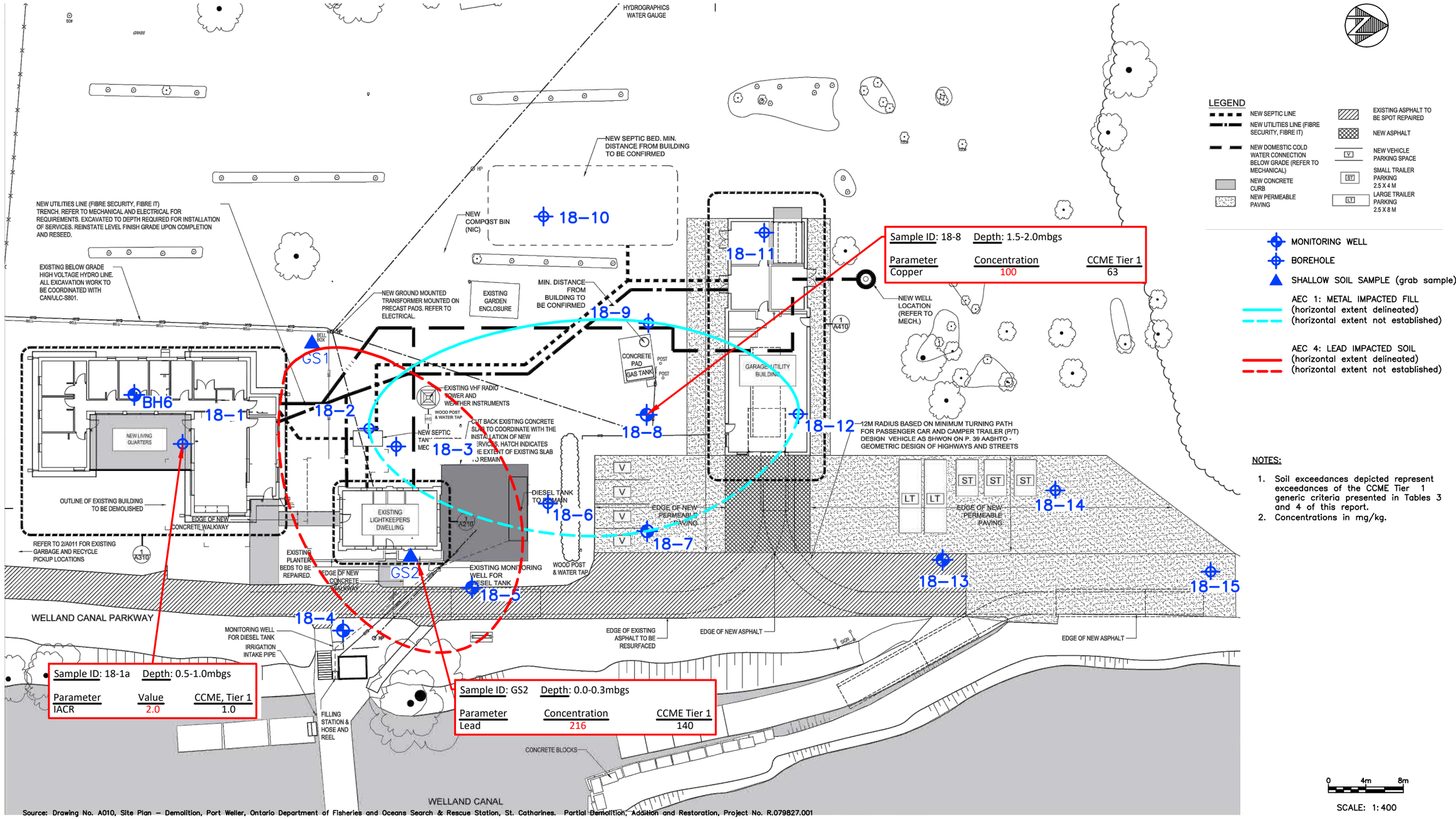
FileName:c:\projectwise\working directory\projects 2018\10\ebdms35138\figure 4 - gw elevations.dwg



Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

FileName:c:\projectwise\working directory\projects 2018\10\rebl\dms351381\figure 5 - soil exceedances.dwg

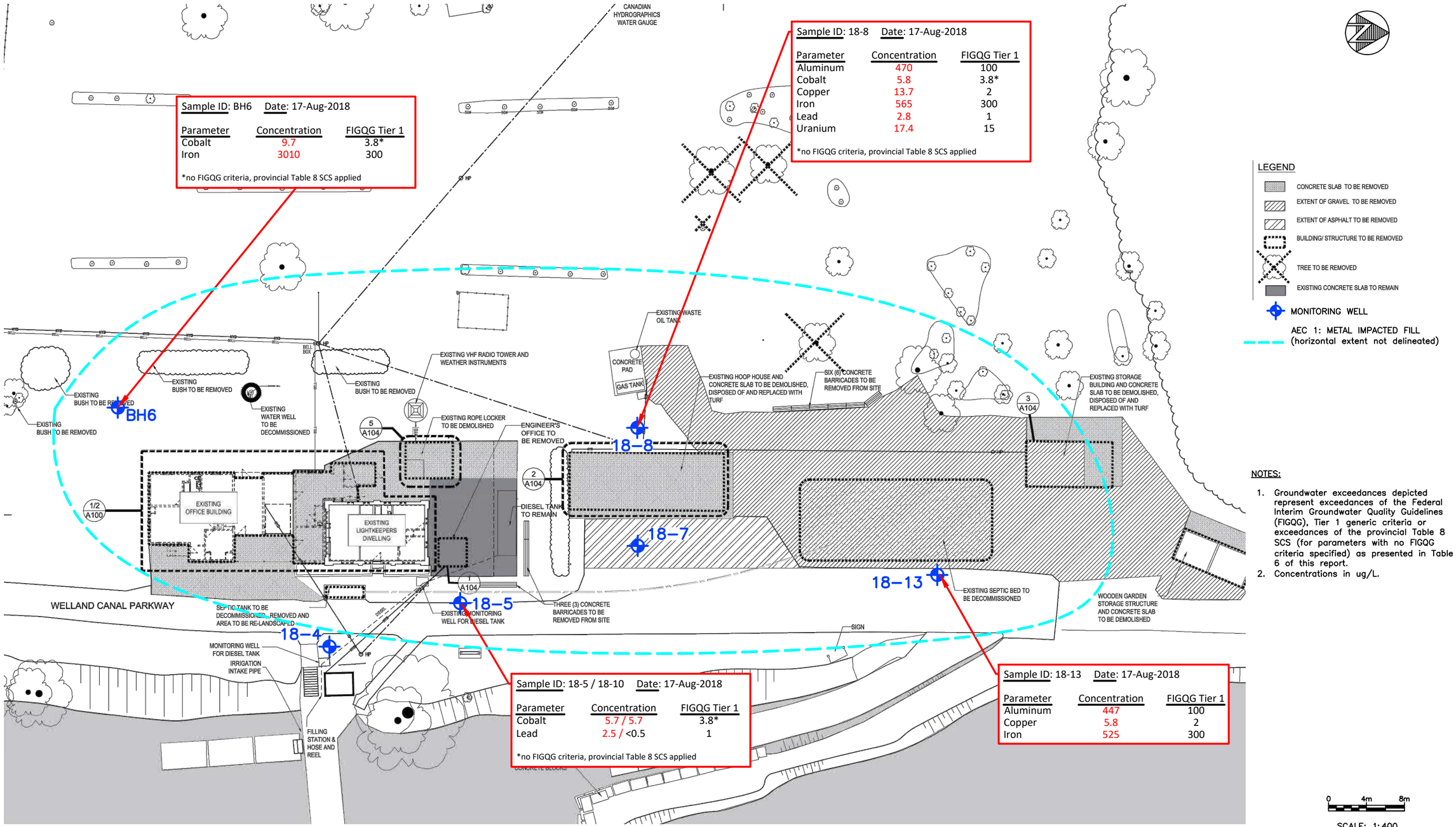
DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: December 2018	TITLE: SOIL EXCEEDANCES - DEMOLITION	FIGURE NO.: 5a



Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

FileName:c:\projectwise\working directory\projects 2018\10\ebdms35138\figure 5 - soil exceedances.dwg

DILLON CONSULTING	PROJECT	SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO. 18-8083
DATE December 2018	TITLE	SOIL EXCEEDANCES - NEW CONSTRUCTION	FIGURE NO. 5b



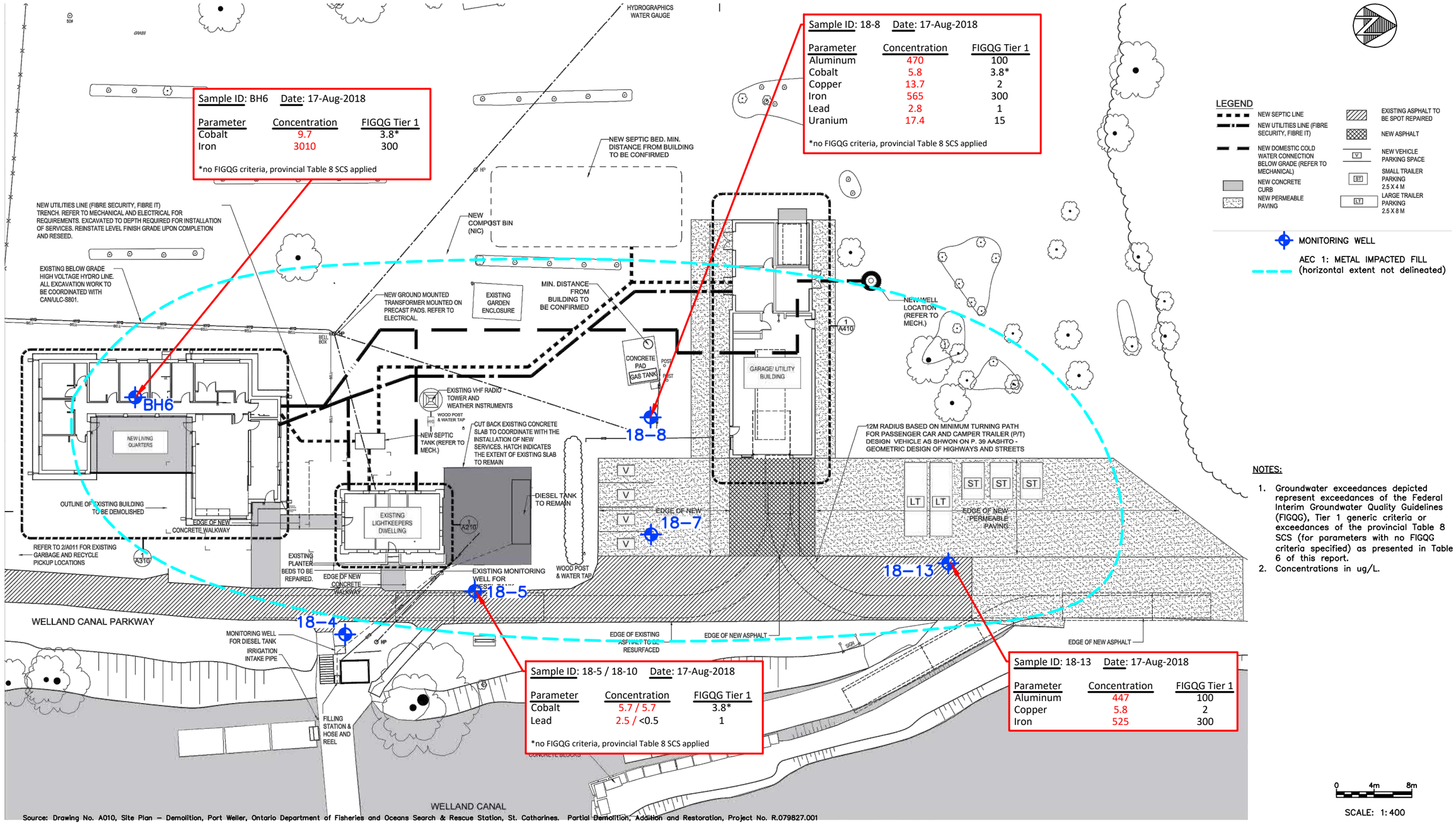
NOTES:

1. Groundwater exceedances depicted represent exceedances of the Federal Interim Groundwater Quality Guidelines (FIGQG), Tier 1 generic criteria or exceedances of the provincial Table 8 SCS (for parameters with no FIGQG criteria specified) as presented in Table 6 of this report.
2. Concentrations in ug/L.

Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: November 2018	TITLE: GROUNDWATER EXCEEDANCES - DEMOLITION	FIGURE NO.: 6a

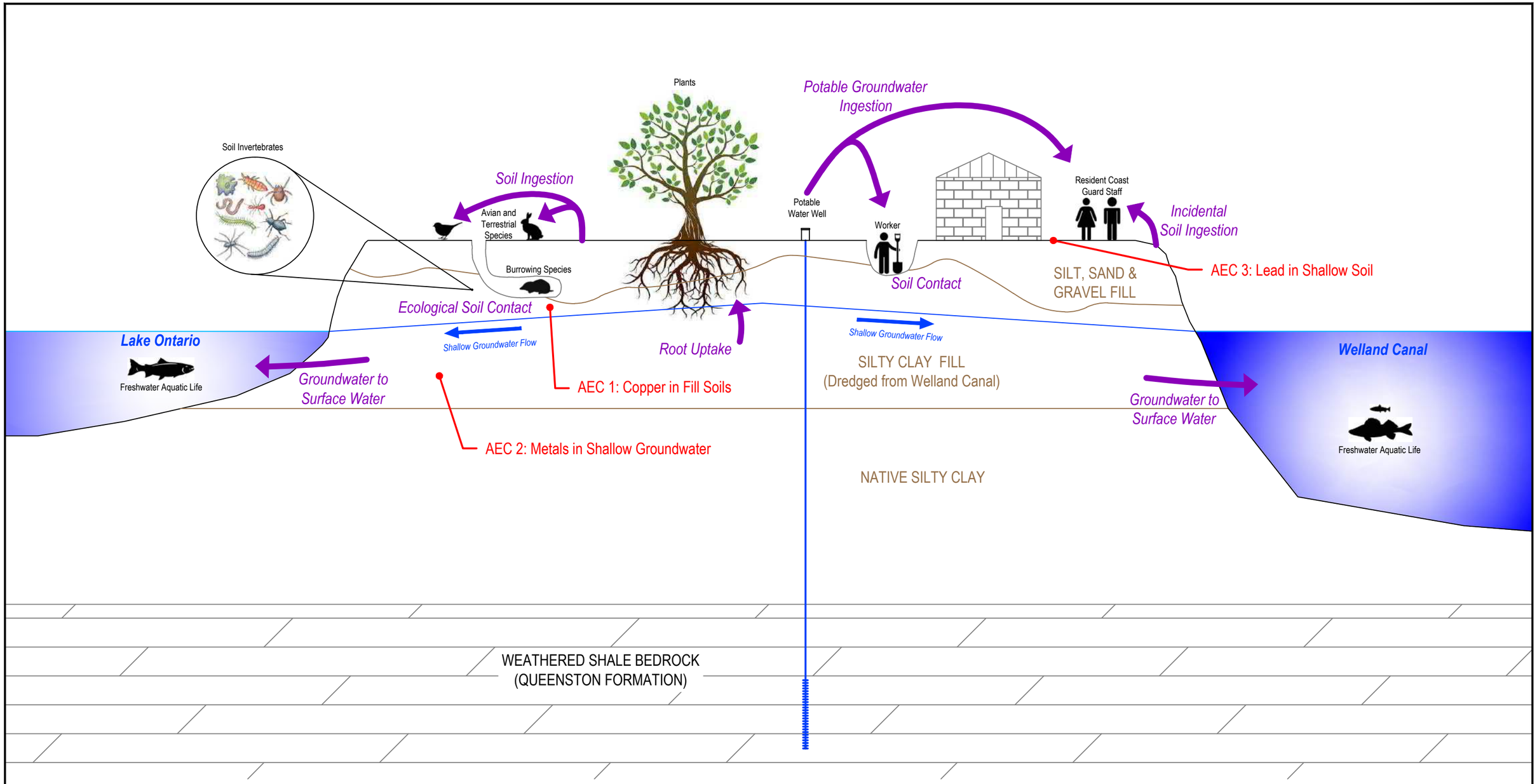
FileName:c:\projectwise\working directory\projects 2018\10\rebl\dms35138\figure 6 - groundwater exceedances.dwg



Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

DILLON CONSULTING	PROJECT	SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO. 18-8083
DATE December 2018	TITLE	GROUNDWATER EXCEEDANCES - NEW CONSTRUCTION	FIGURE NO. 6b

FileName:c:\projectwise\working directory\projects 2018\10\ebdms35138\figure 6 - groundwater exceedances.dwg



SCALE: NOT TO SCALE

DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: November 2018	TITLE: CONCEPTUAL SITE MODEL	FIGURE NO.: 7

FileName:c:\projectwise\working directory\projects 2018\10reb\dms35138\figure 7 - csm.dwg

Appendix A

Borehole Logs

DILLON CONSULTING

Borehole ID: 18-1

UTM Coordinates: (NAD83, Zone 17T) 4788592.92m N, 644606.23m E

Client: Public Services and Procurement Canada
Project No.: 18-8083
Drilling Co.: Direct Environmental Drilling
Observer: J.Sikorski

Project: Soil and Groundwater Assessment
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Method: Geoprobe (direct push)
Date Started: 15-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil					0				78
	Sand and Gravel Fill Grey, some silt, coarse to fine, compact, dry.			0.53	18-1a M+I, PAHs		70			
1	**Silty Clay Fill** Brown to grey, trace fine gravel, moist to dry, firm.			0.91		0				77
	Silt Fill Red brown, some fine gravel, trace clay, dry, stiff.			1.52		0				
2						0	60			76
3						0				75
					18-1b PHCs, BTEX		70			
4						0				74
	Silty Clay Fill Grey to brown, trace fine gravel, moist, firm.			4.57		0				
5						0	60			73
6										
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite			6.09						72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Sandy Gravel; Silt / Clay; Silty Gravel

Casing: n/a
Grade Elevation (m asl) : 78.28
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-2

UTM Coordinates: (NAD83, Zone 17T) 4788612.87m N, 644604.59m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push)
Observer: J.Sikorski
Date Started: 15-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil			0.1						78
	Silt and Sand Fill Red to brown, coarse to fine, moist, compact.			0.13		0				
	Silt Fill Reddish brown to grey, some sand, trace clay, trace coarse gravel.						20			
1						0				77
					18-2a M+I, PAHs					
						0				
2							60			76
	Silty Clay Fill Brown to grey, trace fine gravel, moist, firm.			2.43		0				
3						0				75
							60			
4						0				74
						0				
5	Increased moisture, soft from 5.18 to 5.49 m.				18-2b PHCs, BTEX		60			73
				5.49		0				
6				6.09						72
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite									

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Silty Sand; Silt; Silt / Clay

Casing: n/a
Grade Elevation (m asl) : 78.07
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-3

UTM Coordinates: (NAD83, Zone 17T) 4788615.79m N, 644606.50m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push)
Observer: J.Sikorski
Date Started: 15-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Concrete			0.07						
	Silt and Sand Fill Brown to grey, coarse to fine, dry, compact.			0.08		0				78
	Silt Fill Red, trace fine sand, trace clay, dry, stiff.			0.44			54			
	Silty Clay Fill Brown to grey, trace fine gravel, trace clay, moist, firm.					0				
1										77
						0				
2							84			76
						0				
3						0				75
	Wet, some sand at 3.83 to 4.01m.				18-3 PHCs, BTEX		48			
4						0				74
	Silt Fill Red, trace fine sand, trace gravel, dry, stiff.			4.24 4.34						
	Silty Clay Fill Brown to grey, trace fine gravel, trace clay, moist, firm.			4.56						
5	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite									73
6										72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS
Silty Sand
Silt
Silt / Clay

Casing: n/a
Grade Elevation (m asl) : 78.26
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-4

UTM Coordinates: (NAD83, Zone 17T) 4788610.53m N, 644627.04m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push and SSA)
Observer: J.Sikorski
Date Started: 14-Aug-18 Date Completed: 14-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil					0			flushmount casing	
	Sand and Gravel Fill Grey, trace silt, dry.			0.5						
1	**Silt Fill** Reddish brown, trace clay, trace fine gravel, trace sand, dry, firm.			0.61		0	80			77
2						0	60			76
3						0			▽	75
4						0	20			74
	Sand and Gravel Fill Grey, some silt, moist.			4.26	18-4 PHCs, BTEX	0				
5	**Silty Clay Fill** Brown to grey, trace fine gravel, moist, firm.			4.87		0	80			73
6						0				72
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - Monitoring well installed using 108 mm diameter solid stem augers - Groundwater level taken on August 28, 2018			6.09						

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Sandy Gravel; Silt; Silt / Clay

▽ Water Level (No Measureable Product)

Casing: 51 mm
Grade Elevation (m asl) : 78.01
Top of Casing Elevation (m asl) : 77.839

DILLON CONSULTING

Borehole ID: 18-5

UTM Coordinates: (NAD83, Zone 17T) 4788623.76m N, 644621.68m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push and SSA)
Observer: J.Sikorski
Date Started: 14-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil								flushmount casing	
	Silt Fill Brown, some fine sand, some gravel, compact, dry.			0.18	18-5a M+I	0				78
	Sand and Gravel Fill Grey, trace to some silt, dry.			0.58		0	50			
1						0				77
2						0	40			76
	Silty Clay Fill Red to brown, some coarse gravel, dry, compact.			2.74		0				
3						0	20			75
4	becoming moist, firm, trace fine gravel at 4.27m.				18-5b PHCs, VOCs	0				74
5						0	60			73
	Silty Clay Fill Grey to brown, trace fine gravel, trace clay, moist, firm. Increased moisture from 5.18 to 5.23m.			5.18		0				
6										72
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - Monitoring well installed using 108 mm diameter solid stem augers - Groundwater level taken on August 28, 2018			6.09						

DILLON MW MOD PORT WELLER.GPJ 9-6-18

LITHOLOGY SYMBOLS: Organics; Sandy Silt; Sandy Gravel; Silt / Clay

Water Level (No Measureable Product)

Casing: 51 mm
Grade Elevation (m asl) : 78.22
Top of Casing Elevation (m asl) : 78.192

DILLON CONSULTING

Borehole ID: 18-6

UTM Coordinates: (NAD83, Zone 17T) 4788632.02m N, 644612.62m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push)
Observer: J.Sikorski
Date Started: 15-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Sample: Vapour TCV (ppm)	Sample: Rec %	Sample: Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil			0.1						78
	Silt and Sand Fill Brown, fine grained, trace fine gravel, dry, stiff.				18-6a M+I	0				
1						0	60			77
	Silty Clay Fill Grey to brown, trace fine gravel, moist, firm.			1.22	18-6b PHCs, BTEX					
2						0				76
						0	80			
3						0				75
						0	60			
4						0				74
				4.56						
5	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite									73
6										72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Sandy Silt; Silt / Clay

Casing: n/a
Grade Elevation (m asl) : 78.19
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-7

UTM Coordinates: (NAD83, Zone 17T) 4788642.63m N, 644615.58m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push and SSA)
Observer: J.Sikorski
Date Started: 14-Aug-18 Date Completed: 14-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Asphalt								flushmount casing	
	Sand and Gravel Fill Grey, coarse to fine, some silt, dry, compact.			0.2		0				78
						0	80			
1	**Silty Clay Fill** Brown to grey, trace fine gravel, moist, firm.			0.91		0				77
	Red from 1.37 to 1.52m.					0				
2						0	80			76
						0				
3						0				75
						0	40			
4						0				74
	Increased moisture from 4.57 to 5.48m.				18-7 PHCs, VOCs, M+I	0				
5						0	44		▽	73
						0				
6	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - Monitoring well installed using 108 mm diameter solid stem augers - Groundwater level taken on August 28, 2018			6.09						72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Asphalt; Sandy Gravel; Silt / Clay

▽ Water Level (No Measureable Product)

Casing: 51 mm
Grade Elevation (m asl) : 78.32
Top of Casing Elevation (m asl) : 78.147

DILLON CONSULTING

Borehole ID: 18-8

UTM Coordinates: (NAD83, Zone 17T) 4788642.52m N, 644603.12m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push and SSA)
Observer: J.Sikorski
Date Started: 14-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil									
	Silt and Gravel Fill Red, coarse, trace fine sand, compact.			0.13		0				
	Silty Clay Fill Brown to grey, trace fine gravel, moist, firm to stiff.			0.53		0	70			
1	Increased moisture, soft from 1.01 to 1.52 m.					0				77
				1.52	18-8 PHCs, VOCs, M+I	0				
2						0	70			76
3						0				75
4						0	70			74
5						0				73
6						0	70			72
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - Monitoring well installed using 108 mm diameter solid stem augers - Groundwater level taken on August 28, 2018			6.09						

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Silty Gravel; Silt / Clay

Water Level (No Measureable Product)

Casing: 51 mm
Grade Elevation (m asl) : 78.16
Top of Casing Elevation (m asl) : 78.067

Borehole ID: 18-9

UTM Coordinates: (NAD83, Zone 17T) 4788642.77m N, 644593.28m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push)
Observer: J.Sikorski
Date Started: 15-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Sample: Vapour TCV (ppm)	Sample: Rec %	Sample: Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil			0.1						
	Silty Clay Fill Brown to grey, trace fine gravel, moist, firm-stiff.					0				
							70			
1						0				77
					18-9 PHCs, VOCs, M+I	0				
2							50			76
						0				
3						0				75
							40			
4						0				74
				4.56						
5	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite									73
6										72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Silt / Clay

Casing: n/a
Grade Elevation (m asl) : 78.03
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-10

UTM Coordinates: (NAD83, Zone 17T) 4788629.51m N, 644582.88m E

Client: Public Services and Procurement Canada
Project No.: 18-8083
Drilling Co.: Direct Environmental Drilling
Observer: J.Sikorski

Project: Soil and Groundwater Assessment
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Method: Geoprobe (direct push)
Date Started: 15-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Sample: Vapour TCV (ppm)	Sample: Rec %	Sample: Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil									
	Sand and Gravel Fill Grey, coarse , trace silt, dry, compact.			0.13		0				78
	Silty Clay Fill Brown to grey, trace fine gravel, moist to dry, stiff.			0.49			80			
1					18-10 M+I	0				77
2						0				76
							70			
3						0				
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite			3.05						75
4										74
5										73
6										72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Sandy Gravel; Silt / Clay

Casing: n/a
Grade Elevation (m asl) : 78.29
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-11

UTM Coordinates: (NAD83, Zone 17T) 4788655.17m N, 644583.62m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push)
Observer: J.Sikorski
Date Started: 15-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil			0.1						
	Sand and Gravel Fill Grey, coarse to fine, some silt, dry, compact, loose.					0				
	Silty Clay Fill Brown to grey, trace fine gravel, moist to dry, firm to stiff.			0.55	18-11 M+I		70			
1						0				77
						0				
2						0				76
							40			
						0				
3						0				75
	Increased moisture below 3.66m.									
						0				
4							60			74
						0				
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite			4.56						
5										73
6										72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Sandy Gravel; Silt / Clay

Casing: n/a
Grade Elevation (m asl) : 78.03
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-12

UTM Coordinates: (NAD83, Zone 17T) 4788658.81m N, 644603.03m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push)
Observer: J.Sikorski
Date Started: 15-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Sample: Vapour TCV (ppm)	Sample: Rec %	Sample: Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Sand and Gravel Fill Grey to brown, coarse to fine, trace silt, dry, loose.					0				78
	Silty Clay Fill Brown to grey, trace fine gravel, dry, firm.			0.71			60			
1	**Silt Fill** Red, trace gravel, trace sand, coarse to fine, dry, firm.			0.91 0.99	18-12 PAHs, PHCs, VOCs, M+I	0				
	Silty Clay Fill Brown to grey, trace fine gravel, moist, firm.									77
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite			1.52						
2										76
3										75
4										74
5										73
6										72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Sandy Gravel; Silt; Silt / Clay

Casing: n/a
Grade Elevation (m asl) : 78.36
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-13

UTM Coordinates: (NAD83, Zone 17T) 4788674.21m N, 644618.80m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push and SSA)
Observer: J.Sikorski
Date Started: 14-Aug-18 Date Completed: 15-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Vapour TCV (ppm)	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Asphalt			0.13					flushmount casing	78
	Sand and Gravel Fill Grey, trace silt, compact to loose, dry.					0				
1							60			77
						0				
	Silt Fill Red, some gravel, some sand, coarse to fine, compact, dry.			1.22						
	Silt Fill Red to brown, some clay, some sand, some gravel, coarse to fine, compact, dry.			1.52		0				
2							44			76
						0				
3						0				75
	Silty Clay Fill Grey to brown, trace fine gravel, moist, firm. Increased moisture, soft from 3.88 to 4.31m.			3.78			50			
4					18-13 M+I, PAHs, PHCs, VOCs	0				74
						0				
5							100			73
						0				
6	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - Monitoring well installed using 108 mm diameter solid stem augers - Groundwater level taken on August 28, 2018			6.09						72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Asphalt; Sandy Gravel; Silt; Silt / Clay

Water Level (No Measureable Product)

Casing: 51 mm
Grade Elevation (m asl) : 78.07
Top of Casing Elevation (m asl) : 77.970

DILLON CONSULTING

Borehole ID: 18-14

UTM Coordinates: (NAD83, Zone 17T) 4788686.32m N, 644611.22m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push)
Observer: J.Sikorski
Date Started: 14-Aug-18 Date Completed: 14-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Sample: Vapour TCV (ppm)	Sample: Rec %	Sample: Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Sand and Gravel Fill Grey, some silt, coarse to fine, loose to compact.					0	66			78
1	**Silty Clay Fill** Grey to brown, trace fine gravel, moist to dry, firm.			0.91	18-14 M+I, PAHs, PHCs, VOCs	0				77
2						5	80			76
3				3.05		0				75
4	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite									74
5										73
6										72

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Sandy Gravel; Silt / Clay

Casing: n/a
Grade Elevation (m asl) : 78.27
Top of Casing Elevation (m asl) : n/a

DILLON CONSULTING

Borehole ID: 18-15

UTM Coordinates: (NAD83, Zone 17T) 4788702.93m N, 644619.91m E

Client: Public Services and Procurement Canada
Project: Soil and Groundwater Assessment
Project No.: 18-8083
Location : 4 Welland Canals Parkway, St. Catherines, ON
Drilling Co.: Direct Environmental Drilling
Drilling Method: Geoprobe (direct push)
Observer: J.Sikorski
Date Started: 14-Aug-18 Date Completed: 14-Aug-18

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Soil Sample ID (analysis) note: sample interval represented with dashed lines	Sample: Vapour TCV (ppm)	Sample: Rec %	Sample: Blows/6"	Borehole Completion Detail	Elev. (m asl)
	Topsoil					5				
	Sand and Gravel Fill Grey, some silt, compact, dry.			0.58			40			77
1	**Sand and Silt Fill** Red, coarse to fine, some fine gravel, compact, dry.			1.04	18-15 M+I, PAHs, PHCs, VOCs	0				
	Sand and Gravel Fill Grey, some silt, compact, dry.			1.22						
						0				76
2							30			
						0				75
3				3.05						
	Notes: - Soil samples collected using 50 mm diameter dual tube sampler advanced using direct push - Vapour readings expressed in parts per million - No monitoring well installed; borehole backfilled with bentonite									74
4										
										73
5										
										72
6										
										71

DILLON MW MOD PORT WELLER.GPJ 9-4-18

LITHOLOGY SYMBOLS: Organics; Sandy Gravel; Sandy Silt

Casing: n/a
Grade Elevation (m asl) : 77.75
Top of Casing Elevation (m asl) : n/a

Appendix B

Laboratory Certificates of Analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: DILLON CONSULTING LTD.
130 Dufferin Avenue
LONDON, ON N6A5R2
(519) 438-6192

ATTENTION TO: Rachel Bryan

PROJECT: Port Weller 188083

AGAT WORK ORDER: 18H374254

SOIL ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer

TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor

DATE REPORTED: Aug 30, 2018

PAGES (INCLUDING COVER): 30

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Ignitability in Soil

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		**Deep**	**Shallow**
		SAMPLE TYPE:		**Soil**	**Soil**
		DATE SAMPLED:		**2018-08-15**	**2018-08-15**
Parameter	**Unit**	**G / S**	**RDL**	**9476505**	**9476506**
Ignitability				N	N

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9476505-9476506 N = Non-Flammable Solid

Certified By: Iris Verástegui

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Metals & Inorganics (Soil)

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

SAMPLE DESCRIPTION:				18-1a	18-2a	18-5a	18-6	18-7	18-8	18-9	18-10
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2018-08-15	2018-08-15	2018-08-14	2018-08-15	2018-08-14	2018-08-14	2018-08-15	2018-08-15
Parameter	Unit	G / S	RDL	9476296	9476303	9476318	9476429	9476430	9476431	9476432	9476487
Antimony	µg/g	20	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	12	1	7	4	5	5	5	5	5	5
Barium	µg/g	500	2	70	123	48	67	123	144	111	141
Beryllium	µg/g	4	0.5	0.8	0.6	<0.5	0.6	0.9	0.7	1.0	0.7
Cadmium	µg/g	10	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	64	2	23	17	16	25	26	19	24	22
Cobalt	µg/g	50	0.5	11.5	9.8	6.4	8.3	13.6	11.9	13.5	12.6
Copper	µg/g	63	1	31	17	18	22	27	**100**	26	18
Lead	µg/g	140	1	27	28	51	83	10	8	11	13
Molybdenum	µg/g	10	0.5	<0.5	0.7	1.0	<0.5	<0.5	0.5	<0.5	0.8
Nickel	µg/g	50	1	25	22	13	18	30	24	29	28
Selenium	µg/g	1	0.4	<0.4	<0.4	<0.4	<0.4	0.4	<0.4	0.5	<0.4
Silver	µg/g	20	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Tin	µg/g	50	1	1	1	<1	1	<1	<1	<1	<1
Uranium	µg/g	23	0.5	<0.5	<0.5	0.5	<0.5	0.7	0.7	0.7	0.6
Vanadium	µg/g	130	1	23	20	16	21	35	28	33	27
Zinc	µg/g	200	5	74	67	77	110	68	55	65	65
Chromium VI	µg/g	0.4	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.9	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g		0.10	<0.10	0.17	3.25	5.51	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	2	0.005	0.162	0.193	0.277	0.259	1.12	0.491	0.201	0.219
Sodium Adsorption Ratio	NA	5	NA	0.163	0.718	0.129	0.465	0.873	0.607	0.220	0.439
pH, 2:1 CaCl2 Extraction	pH Units	6.0-8.0	NA	7.42	7.52	7.27	7.29	7.52	7.55	7.54	7.50

Certified By: Iris Verástegui

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Metals & Inorganics (Soil)

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

SAMPLE DESCRIPTION:				18-11	18-12	18-13	18-14	18-15	DUP 1	DUP 2
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2018-08-15	2018-08-15	2018-08-14	2018-08-14	2018-08-14	2018-08-15	2018-08-15
Parameter	Unit	G / S	RDL	9476488	9476496	9476497	9476498	9476499	9484714	9484715
Antimony	µg/g	20	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	12	1	2	4	11	4	9	12	4
Barium	µg/g	500	2	62	129	59	125	22	70	153
Beryllium	µg/g	4	0.5	0.9	0.9	0.8	1.1	0.8	0.8	1.0
Cadmium	µg/g	10	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	64	2	23	26	15	30	21	18	34
Cobalt	µg/g	50	0.5	11.9	14.0	13.5	14.8	14.3	13.3	15.0
Copper	µg/g	63	1	6	26	46	27	35	34	26
Lead	µg/g	140	1	5	10	6	11	10	6	11
Molybdenum	µg/g	10	0.5	1.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/g	50	1	30	30	27	34	28	27	34
Selenium	µg/g	1	0.4	<0.4	<0.4	<0.4	0.6	<0.4	0.4	<0.4
Silver	µg/g	20	0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Tin	µg/g	50	1	<1	<1	<1	<1	<1	<1	<1
Uranium	µg/g	23	0.5	0.6	0.8	<0.5	0.8	<0.5	0.5	0.8
Vanadium	µg/g	130	1	21	34	17	39	19	22	45
Zinc	µg/g	200	5	59	64	56	74	131	61	68
Chromium VI	µg/g	0.4	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.9	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g		0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	2	0.005	0.142	0.285	0.152	0.941	0.121	0.337	0.671
Sodium Adsorption Ratio	NA	5	NA	0.263	1.30	0.673	0.374	0.207	1.77	0.461
pH, 2:1 CaCl2 Extraction	pH Units	6.0-8.0	NA	7.23	7.47	7.57	7.58	7.59	7.69	7.70

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME 2008 (R/P,F)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9476296-9484715 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Iris Verástegui

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 558 Metals and Inorganics

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		Deep	Shallow
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2018-08-15	2018-08-15
Parameter	Unit	G / S	RDL	9476505	9476506
Arsenic Leachate	mg/L	2.5	0.010	<0.010	<0.010
Barium Leachate	mg/L	100	0.100	0.890	1.32
Boron Leachate	mg/L	500	0.050	0.051	0.066
Cadmium Leachate	mg/L	0.5	0.010	<0.010	<0.010
Chromium Leachate	mg/L	5	0.010	<0.010	<0.010
Lead Leachate	mg/L	5	0.010	<0.010	<0.010
Mercury Leachate	mg/L	0.1	0.01	<0.01	<0.01
Selenium Leachate	mg/L	1	0.010	<0.010	<0.010
Silver Leachate	mg/L	5	0.010	<0.010	<0.010
Uranium Leachate	mg/L	10	0.050	<0.050	<0.050
Fluoride Leachate	mg/L	150	0.05	0.29	0.21
Cyanide Leachate	mg/L	20	0.05	<0.05	<0.05
(Nitrate + Nitrite) as N Leachate	mg/L	1000	0.70	<0.70	<0.70

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Certified By: Iris Verástegui

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

BTEX - Soil - (P & T - GC/MS)

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		18-3	18-4	18-6	18-1b	18-2b	DUP 3
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2018-08-15	2018-08-14	2018-08-15	2018-08-15	2018-08-15	2018-08-15
Parameter	**Unit**	**G / S**	**RDL**	**9476305**	**9476311**	**9476429**	**9484711**	**9484712**	**9484716**
Benzene	µg/g	0.0068	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Toluene	µg/g	0.37	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ethylbenzene	µg/g	0.018	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
m & p-Xylene	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Xylene	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Xylene Mixture (Total)	µg/g	2.4	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Moisture Content	%		0.1	22.8	23.9	24.8	25.3	14.9	24.5
Surrogate	**Unit**	**Acceptable Limits**							
Toluene-d8	% Recovery	60-130		108	104	105	106	112	106
4-Bromofluorobenzene	% Recovery	70-130		102	95	105	98	87	99

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME 2008 (R/P,F)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9476305-9484716 Results are based on the dry weight of the soil.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Moisture

DATE RECEIVED: 2018-08-16 **DATE REPORTED: 2018-08-30**

		SAMPLE DESCRIPTION:		18-1a	18-2a	18-12	18-13	18-14	18-15	DUP 1
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2018-08-15	2018-08-15	2018-08-15	2018-08-14	2018-08-14	2018-08-14	2018-08-15
Parameter	Unit	G / S	RDL	9476296	9476303	9476496	9476497	9476498	9476499	9484714
% Moisture	%		0	8	13	18	21	22	8	18

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 558 - Benzo(a) pyrene

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		Deep	Shallow
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2018-08-15	2018-08-15
Parameter	Unit	G / S	RDL	9476505	9476506
Benzo(a)pyrene	mg/L	0.001	0.001	<0.001	<0.001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9476505-9476506 The sample was leached according to Regulation 558 protocol. Analysis was performed on the leachate.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 558 - VOCs

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		Deep	Shallow
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2018-08-15	2018-08-15
Parameter	**Unit**	**G / S**	**RDL**	**9476505**	**9476506**
Vinyl Chloride	mg/L	0.2	0.030	<0.030	<0.030
1,1 Dichloroethene	mg/L	1.4	0.020	<0.020	<0.020
Dichloromethane	mg/L	5.0	0.030	<0.030	<0.030
Methyl Ethyl Ketone	mg/L	200	0.090	<0.090	<0.090
Chloroform	mg/L	10.0	0.020	<0.020	<0.020
1,2-Dichloroethane	mg/L	0.5	0.020	<0.020	<0.020
Carbon Tetrachloride	mg/L	0.5	0.020	<0.020	<0.020
Benzene	mg/L	0.5	0.020	<0.020	<0.020
Trichloroethene	mg/L	5.0	0.020	<0.020	<0.020
Tetrachloroethene	mg/L	3.0	0.050	<0.050	<0.050
Chlorobenzene	mg/L	8.0	0.010	<0.010	<0.010
1,2-Dichlorobenzene	mg/L	20.0	0.010	<0.010	<0.010
1,4-Dichlorobenzene	mg/L	0.5	0.010	<0.010	<0.010
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	% Recovery	60-130		99	101

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9476505-9476506 Sample was prepared using Regulation 558 protocol and a zero headspace extractor.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PHCs F1 - F4 (-BTEX) (Soil)

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		18-7	18-8	18-9	18-12	18-13	18-14	18-15	18-5b
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2018-08-14	2018-08-14	2018-08-15	2018-08-15	2018-08-14	2018-08-14	2018-08-14	2018-08-15
Parameter	**Unit**	**G / S**	**RDL**	**9476430**	**9476431**	**9476432**	**9476496**	**9476497**	**9476498**	**9476499**	**9484713**
F1 (C6 to C10)	µg/g		5	<5	<5	<5	<5	<5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g		5	<5	<5	<5	<5	<5	<5	<5	<5
F2 (C10 to C16)	µg/g		10	<10	<10	<10	<10	<10	<10	<10	<10
F3 (C16 to C34)	µg/g		50	<50	<50	<50	<50	<50	<50	<50	<50
F4 (C34 to C50)	µg/g		50	<50	<50	<50	<50	<50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA	NA	NA	NA	NA	NA	NA
Moisture Content	%		0.1	18.8	12.8	12.6	15.3	17.7	23.0	15.1	24.8
Surrogate	**Unit**	**Acceptable Limits**									
Terphenyl	%	60-140		115	109	127	119	9+	71	102	91

		SAMPLE DESCRIPTION:		DUP 1
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2018-08-15
Parameter	**Unit**	**G / S**	**RDL**	**9484714**
F1 (C6 to C10)	µg/g		5	<5
F1 (C6 to C10) minus BTEX	µg/g		5	<5
F2 (C10 to C16)	µg/g		10	<10
F3 (C16 to C34)	µg/g		50	<50
F4 (C34 to C50)	µg/g		50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA
Moisture Content	%		0.1	20.4
Surrogate	**Unit**	**Acceptable Limits**		
Terphenyl	%	60-140		101

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PHCs F1 - F4 (-BTEX) (Soil)

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME 2008 (R/P,F)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9476430-9484714 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified without the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PHCs F1 - F4 (Soil)

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		18-3	18-4	18-6	18-1b	18-2b	DUP 3
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2018-08-15	2018-08-14	2018-08-15	2018-08-15	2018-08-15	2018-08-15
Parameter	**Unit**	**G / S**	**RDL**	**9476305**	**9476311**	**9476429**	**9484711**	**9484712**	**9484716**
F1 (C6 to C10)	µg/g		5	<5	<5	<5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g		5	<5	<5	<5	<5	<5	<5
F2 (C10 to C16)	µg/g		10	<10	<10	<10	<10	<10	<10
F3 (C16 to C34)	µg/g		50	<50	<50	<50	<50	<50	<50
F4 (C34 to C50)	µg/g		50	<50	<50	<50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA	NA	NA	NA	NA
Moisture Content	%		0.1	22.8	23.9	24.8	25.3	14.9	24.5
Surrogate	**Unit**	**Acceptable Limits**							
Terphenyl	%	60-140		106	108	92	72	72	110

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME 2008 (R/P,F)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9476305-9484716 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Polycyclic Aromatic Hydrocarbons in Soil

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		18-1a	18-2a	18-12	18-13	18-14	18-15	DUP 1
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2018-08-15	2018-08-15	2018-08-15	2018-08-14	2018-08-14	2018-08-14	2018-08-15
Parameter	**Unit**	**G / S**	**RDL**	**9476296**	**9476303**	**9476496**	**9476497**	**9476498**	**9476499**	**9484714**
1-Methylnaphthalene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	mg/kg		0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	mg/kg		0.00671	0.0772	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671
Acenaphthylene	mg/kg		0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.005	<0.004
Acridine	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg		0.03	0.09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Benzo(a)anthracene	mg/kg		0.01	0.13	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Benzo(a)pyrene	mg/kg		0.01	0.11	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Benzo(b)fluoranthene	mg/kg		0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b+j)fluoranthene	mg/kg		0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(e)pyrene	mg/kg		0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(ghi)perylene	mg/kg		0.01	0.07	<0.01	<0.01	<0.01	<0.01	0.02	<0.01
Benzo(k)fluoranthene	mg/kg		0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	mg/kg		0.01	0.14	<0.01	<0.01	<0.01	<0.01	0.02	<0.01
Dibenzo(a,h)anthracene	mg/kg		0.006	0.012	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Fluoranthene	mg/kg		0.05	0.32	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg		0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3)pyrene	mg/kg		0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	mg/kg		0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	mg/kg		0.03	0.48	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	mg/kg		0.05	0.33	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Quinoline	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Surrogate	**Unit**	**Acceptable Limits**								
Nitrobenzene-d5	%	50-140		92	89	79	69	81	78	82
2-Fluorobiphenyl	%	50-140		94	86	71	63	93	77	84
Terphenyl-d14	%	50-140		89	95	77	73	81	82	87

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Polycyclic Aromatic Hydrocarbons in Soil

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9476296-9484714 Results are based on the dry weight of the soil.

Benzo(b)fluoranthene may include contributions from benzo(j)fluoranthene, if also present in the sample.

Certified By:

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Volatile Organic Compounds in Soil

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		18-7	18-8	18-9	18-12	18-13	18-14	18-15	18-5b
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2018-08-14	2018-08-14	2018-08-15	2018-08-15	2018-08-14	2018-08-14	2018-08-14	2018-08-15
Parameter	Unit	G / S	RDL	9476430	9476431	9476432	9476496	9476497	9476498	9476499	9484713
Dichlorodifluoromethane	µg/g		0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chloromethane	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Vinyl Chloride	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Bromomethane	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chloroethane	µg/g		0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Trichlorofluoromethane	µg/g		0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Acetone	µg/g		0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
1,1-Dichloroethylene	µg/g	5	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Methylene Chloride	µg/g		0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
TRANS-1,2-Dichloroethylene	µg/g	5	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Methyl tert-butyl Ether	µg/g		0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
1,1-Dichloroethane	µg/g	5	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Methyl Ethyl Ketone	µg/g		0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
CIS 1,2-Dichloroethylene	µg/g	0.1	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chloroform	µg/g	5	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,2- Dichloroethane	µg/g	0.1	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,1,1-Trichloroethane	µg/g	5	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Carbon Tetrachloride	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Benzene	µg/g	0.0068	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,2-Dichloropropane	µg/g	5	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Trichloroethylene	µg/g	0.01	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Bromodichloromethane	µg/g		0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
CIS-1,3-Dichloropropene	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Methyl Isobutyl Ketone	µg/g		0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
TRANS-1,3-Dichloropropene	µg/g		0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
1,1,2-Trichloroethane	µg/g	5	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Toluene	µg/g	0.37	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Hexanone	µg/g		0.470	<0.470	<0.470	<0.470	<0.470	<0.470	<0.470	<0.470	<0.470
Dibromochloromethane	µg/g		0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Ethylene Dibromide	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Volatile Organic Compounds in Soil

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		18-7	18-8	18-9	18-12	18-13	18-14	18-15	18-5b
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2018-08-14	2018-08-14	2018-08-15	2018-08-15	2018-08-14	2018-08-14	2018-08-14	2018-08-15
Parameter	**Unit**	**G / S**	**RDL**	**9476430**	**9476431**	**9476432**	**9476496**	**9476497**	**9476498**	**9476499**	**9484713**
Tetrachloroethylene	µg/g	0.2	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,1,1,2-Tetrachloroethane	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chlorobenzene	µg/g	1	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ethylbenzene	µg/g	0.018	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
m & p-Xylene	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Bromoform	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Styrene	µg/g	5	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,1,2,2- Tetrachloroethane	µg/g	5	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
o-Xylene	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,3-Dichlorobenzene	µg/g	1	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,4-Dichlorobenzene	µg/g	1	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,2-Dichlorobenzene	µg/g	1	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,2,4-Trichlorobenzene	µg/g	0.05	0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Xylene Mixture (Total)	µg/g	2.4	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,3-Dichloropropene (Cis + Trans)	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
n-Hexane	µg/g		0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Moisture Content	%		0.1	18.8	12.8	12.6	15.3	17.7	23.0	15.1	24.8
Surrogate	**Unit**	**Acceptable Limits**									
Toluene-d8	% Recovery	60-130		108	105	106	94	106	107	114	107
4-Bromofluorobenzene	% Recovery	70-130		98	97	105	105	94	98	96	100

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Volatile Organic Compounds in Soil

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		DUP 1
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2018-08-15
Parameter	Unit	G / S	RDL	9484714
Dichlorodifluoromethane	µg/g		0.005	<0.005
Chloromethane	µg/g		0.002	<0.002
Vinyl Chloride	µg/g		0.002	<0.002
Bromomethane	µg/g		0.002	<0.002
Chloroethane	µg/g		0.005	<0.005
Trichlorofluoromethane	µg/g		0.004	<0.004
Acetone	µg/g		0.130	<0.130
1,1-Dichloroethylene	µg/g	5	0.002	<0.002
Methylene Chloride	µg/g		0.003	<0.003
TRANS-1,2-Dichloroethylene	µg/g	5	0.003	<0.003
Methyl tert-butyl Ether	µg/g		0.004	<0.004
1,1-Dichloroethane	µg/g	5	0.002	<0.002
Methyl Ethyl Ketone	µg/g		0.10	<0.10
CIS 1,2-Dichloroethylene	µg/g	0.1	0.002	<0.002
Chloroform	µg/g	5	0.002	<0.002
1,2- Dichloroethane	µg/g	0.1	0.002	<0.002
1,1,1-Trichloroethane	µg/g	5	0.002	<0.002
Carbon Tetrachloride	µg/g		0.002	<0.002
Benzene	µg/g	0.0068	0.002	<0.002
1,2-Dichloropropane	µg/g	5	0.002	<0.002
Trichloroethylene	µg/g	0.01	0.004	<0.004
Bromodichloromethane	µg/g		0.003	<0.003
CIS-1,3-Dichloropropene	µg/g		0.002	<0.002
Methyl Isobutyl Ketone	µg/g		0.10	<0.10
TRANS-1,3-Dichloropropene	µg/g		0.003	<0.003
1,1,2-Trichloroethane	µg/g	5	0.002	<0.002
Toluene	µg/g	0.37	0.002	<0.002
2-Hexanone	µg/g		0.470	<0.470
Dibromochloromethane	µg/g		0.003	<0.003
Ethylene Dibromide	µg/g		0.002	<0.002

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Volatile Organic Compounds in Soil

DATE RECEIVED: 2018-08-16

DATE REPORTED: 2018-08-30

		SAMPLE DESCRIPTION:		DUP 1
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2018-08-15
Parameter	**Unit**	**G / S**	**RDL**	**9484714**
Tetrachloroethylene	µg/g	0.2	0.002	<0.002
1,1,1,2-Tetrachloroethane	µg/g		0.002	<0.002
Chlorobenzene	µg/g	1	0.002	<0.002
Ethylbenzene	µg/g	0.018	0.002	<0.002
m & p-Xylene	µg/g		0.002	<0.002
Bromoform	µg/g		0.002	<0.002
Styrene	µg/g	5	0.002	<0.002
1,1,2,2- Tetrachloroethane	µg/g	5	0.004	<0.004
o-Xylene	µg/g		0.002	<0.002
1,3-Dichlorobenzene	µg/g	1	0.002	<0.002
1,4-Dichlorobenzene	µg/g	1	0.002	<0.002
1,2-Dichlorobenzene	µg/g	1	0.002	<0.002
1,2,4-Trichlorobenzene	µg/g	0.05	0.007	<0.007
Xylene Mixture (Total)	µg/g	2.4	0.002	<0.002
1,3-Dichloropropene (Cis + Trans)	µg/g		0.002	<0.002
n-Hexane	µg/g		0.005	<0.005
Moisture Content	%		0.1	20.4
Surrogate	**Unit**	**Acceptable Limits**		
Toluene-d8	% Recovery	60-130		111
4-Bromofluorobenzene	% Recovery	70-130		103

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME 2008 (R/P,F)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9476430-9484714 Results are based on the dry weight of the soil.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Guideline Violation

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
9476431	18-8	ON CCME 2008 (R/P,F)	Metals & Inorganics (Soil)	Copper	µg/g	63	100

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Aug 30, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Metals & Inorganics (Soil)															
Antimony	9476296	9476296	<0.8	<0.8	NA	< 0.8	115%	70%	130%	95%	80%	120%	79%	70%	130%
Arsenic	9476296	9476296	7	6	15.4%	< 1	106%	70%	130%	95%	80%	120%	94%	70%	130%
Barium	9476296	9476296	70	69	1.4%	< 2	95%	70%	130%	87%	80%	120%	83%	70%	130%
Beryllium	9476296	9476296	0.8	0.8	NA	< 0.5	113%	70%	130%	100%	80%	120%	104%	70%	130%
Cadmium	9476296	9476296	<0.5	<0.5	NA	< 0.5	105%	70%	130%	98%	80%	120%	98%	70%	130%
Chromium	9476296	9476296	23	19	19.0%	< 2	83%	70%	130%	98%	80%	120%	101%	70%	130%
Cobalt	9476296	9476296	11.5	11.3	1.8%	< 0.5	95%	70%	130%	96%	80%	120%	91%	70%	130%
Copper	9476296	9476296	31	31	0.0%	< 1	94%	70%	130%	101%	80%	120%	106%	70%	130%
Lead	9476296	9476296	27	27	0.0%	< 1	108%	70%	130%	99%	80%	120%	91%	70%	130%
Molybdenum	9476296	9476296	<0.5	<0.5	NA	< 0.5	101%	70%	130%	107%	80%	120%	100%	70%	130%
Nickel	9476296	9476296	25	24	4.1%	< 1	97%	70%	130%	96%	80%	120%	88%	70%	130%
Selenium	9476296	9476296	<0.4	<0.4	NA	< 0.4	122%	70%	130%	96%	80%	120%	91%	70%	130%
Silver	9476296	9476296	<0.2	<0.2	NA	< 0.2	114%	70%	130%	95%	80%	120%	92%	70%	130%
Thallium	9476296	9476296	<0.4	<0.4	NA	< 0.4	92%	70%	130%	92%	80%	120%	88%	70%	130%
Tin	9476296	9476296	1	2	NA	< 1	113%	70%	130%	105%	80%	120%	103%	70%	130%
Uranium	9476296	9476296	<0.5	<0.5	NA	< 0.5	96%	70%	130%	96%	80%	120%	98%	70%	130%
Vanadium	9476296	9476296	23	23	0.0%	< 1	90%	70%	130%	95%	80%	120%	88%	70%	130%
Zinc	9476296	9476296	74	74	0.0%	< 5	99%	70%	130%	103%	80%	120%	120%	70%	130%
Chromium VI	9480212		<0.2	<0.2	NA	< 0.2	73%	70%	130%	98%	80%	120%	102%	70%	130%
Cyanide	9484082		<0.040	<0.040	NA	< 0.040	100%	70%	130%	93%	80%	120%	108%	70%	130%
Mercury	9476296	9476296	<0.10	<0.10	NA	< 0.10	98%	70%	130%	97%	80%	120%	89%	70%	130%
Electrical Conductivity	9493697	9476296	0.128	0.135	5.3%	< 0.005	97%	90%	110%	NA			NA		
Sodium Adsorption Ratio	9476296	9476296	0.163	0.139	15.9%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	9480245		7.82	7.83	0.1%	NA	100%	80%	120%	NA			NA		
Metals & Inorganics (Soil)															
Electrical Conductivity	9493697		0.128	0.135	5.3%	< 0.005	NA	90%	110%						
Sodium Adsorption Ratio	9493697		0.551	0.587	6.3%	NA	NA								
O. Reg. 558 Metals and Inorganics															
Arsenic Leachate	9476184		<0.010	<0.010	NA	< 0.010	97%	90%	110%	97%	80%	120%	107%	70%	130%
Barium Leachate	9476184		0.610	0.564	7.8%	< 0.100	100%	90%	110%	95%	80%	120%	102%	70%	130%
Boron Leachate	9476184		0.065	0.060	NA	< 0.050	100%	90%	110%	99%	80%	120%	98%	70%	130%
Cadmium Leachate	9476184		<0.010	<0.010	NA	< 0.010	101%	90%	110%	101%	80%	120%	105%	70%	130%
Chromium Leachate	9476184		<0.010	<0.010	NA	< 0.010	101%	90%	110%	102%	80%	120%	97%	70%	130%
Lead Leachate	9476184		0.076	0.072	5.4%	< 0.010	100%	90%	110%	97%	80%	120%	98%	70%	130%
Mercury Leachate	9476184		<0.01	<0.01	NA	< 0.01	100%	90%	110%	88%	80%	120%	93%	70%	130%
Selenium Leachate	9476184		<0.010	<0.010	NA	< 0.010	103%	90%	110%	112%	80%	120%	118%	70%	130%
Silver Leachate	9476184		<0.010	<0.010	NA	< 0.010	98%	90%	110%	99%	80%	120%	96%	70%	130%
Uranium Leachate	9476184		<0.050	<0.050	NA	< 0.050	102%	90%	110%	99%	80%	120%	102%	70%	130%

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Aug 30, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Fluoride Leachate	9476184		0.20	0.20	NA	< 0.05	105%	90%	110%	108%	90%	110%	103%	70%	130%
Cyanide Leachate	9476184		<0.05	<0.05	NA	< 0.05	100%	90%	110%	93%	90%	110%	105%	70%	130%
(Nitrate + Nitrite) as N Leachate	9476845		<0.70	<0.70	NA	< 0.70	105%	80%	120%	100%	80%	120%	86%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Iris Verástegui

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Aug 30, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
PHCs F1 - F4 (Soil)															
F1 (C6 to C10)	9476432	9476432	< 5	< 5	NA	< 5	87%	60%	130%	87%	85%	115%	86%	70%	130%
F2 (C10 to C16)	9487435		< 10	< 10	NA	< 10	96%	60%	130%	108%	80%	120%	105%	70%	130%
F3 (C16 to C34)	9487435		< 50	< 50	NA	< 50	103%	60%	130%	93%	80%	120%	96%	70%	130%
F4 (C34 to C50)	9487435		< 50	< 50	NA	< 50	82%	60%	130%	94%	80%	120%	86%	70%	130%
O. Reg. 558 - VOCs															
Vinyl Chloride	9484024		< 0.030	< 0.030	NA	< 0.030	105%	60%	140%	116%	60%	140%	NA	60%	140%
1,1 Dichloroethene	9484024		< 0.020	< 0.020	NA	< 0.020	97%	70%	130%	89%	70%	130%	NA	60%	140%
Dichloromethane	9484024		< 0.030	< 0.030	NA	< 0.030	80%	70%	130%	91%	70%	130%	NA	60%	140%
Methyl Ethyl Ketone	9484024		< 0.090	< 0.090	NA	< 0.090	71%	70%	130%	98%	70%	130%	NA	60%	140%
Chloroform	9484024		< 0.020	< 0.020	NA	< 0.020	79%	70%	130%	96%	70%	130%	NA	60%	140%
1,2-Dichloroethane	9484024		< 0.020	< 0.020	NA	< 0.020	85%	70%	130%	88%	70%	130%	NA	60%	140%
Carbon Tetrachloride	9484024		< 0.020	< 0.020	NA	< 0.020	89%	70%	130%	85%	70%	130%	NA	60%	140%
Benzene	9484024		< 0.020	< 0.020	NA	< 0.020	94%	70%	130%	94%	70%	130%	NA	60%	140%
Trichloroethene	9484024		< 0.020	< 0.020	NA	< 0.020	90%	70%	130%	79%	70%	130%	NA	60%	140%
Tetrachloroethene	9484024		< 0.050	< 0.050	NA	< 0.050	96%	70%	130%	91%	70%	130%	NA	60%	140%
Chlorobenzene	9484024		< 0.010	< 0.010	NA	< 0.010	95%	70%	130%	95%	70%	130%	NA	60%	140%
1,2-Dichlorobenzene	9484024		< 0.010	< 0.010	NA	< 0.010	90%	70%	130%	94%	70%	130%	NA	60%	140%
1,4-Dichlorobenzene	9484024		< 0.010	< 0.010	NA	< 0.010	89%	70%	130%	92%	70%	130%	NA	60%	140%
O. Reg. 558 - Benzo(a) pyrene															
Benzo(a)pyrene	9237659		< 0.001	< 0.001	NA	< 0.001	102%	70%	130%	103%	70%	130%	NA	70%	130%
BTEX - Soil - (P & T - GC/MS)															
Benzene	9474716	9474716	< 0.002	< 0.002	NA	< 0.002	106%	60%	130%	108%	60%	130%	89%	60%	130%
Toluene	9474716	9474716	< 0.002	< 0.002	NA	< 0.002	113%	60%	130%	111%	60%	130%	93%	60%	130%
Ethylbenzene	9474716	9474716	< 0.002	< 0.002	NA	< 0.002	110%	60%	130%	99%	60%	130%	92%	60%	130%
m & p-Xylene	9474716	9474716	< 0.002	< 0.002	NA	< 0.002	101%	60%	130%	99%	60%	130%	89%	60%	130%
o-Xylene	9474716	9474716	< 0.002	< 0.002	NA	< 0.002	103%	60%	130%	100%	60%	130%	85%	60%	130%
Volatile Organic Compounds in Soil															
Dichlorodifluoromethane	9474716		< 0.005	< 0.005	NA	< 0.005	95%	60%	130%	83%	60%	130%	82%	60%	130%
Chloromethane	9474716		< 0.002	< 0.002	NA	< 0.002	115%	60%	130%	91%	60%	130%	84%	60%	130%
Vinyl Chloride	9474716		< 0.002	< 0.002	NA	< 0.002	100%	60%	130%	102%	60%	130%	114%	60%	130%
Bromomethane	9474716		< 0.002	< 0.002	NA	< 0.002	115%	60%	130%	106%	60%	130%	112%	60%	130%
Chloroethane	9474716		< 0.005	< 0.005	NA	< 0.005	109%	60%	130%	93%	60%	130%	108%	60%	130%
Trichlorofluoromethane	9474716		< 0.004	< 0.004	NA	< 0.004	111%	60%	130%	84%	60%	130%	111%	60%	130%
Acetone	9474716		< 0.130	< 0.130	NA	< 0.130	121%	60%	130%	99%	60%	130%	84%	60%	130%
1,1-Dichloroethylene	9474716		< 0.002	< 0.002	NA	< 0.002	101%	60%	130%	107%	60%	130%	100%	60%	130%
Methylene Chloride	9474716		< 0.003	< 0.003	NA	< 0.003	112%	60%	130%	95%	60%	130%	103%	60%	130%
TRANS-1,2-Dichloroethylene	9474716		< 0.003	< 0.003	NA	< 0.003	100%	60%	130%	112%	60%	130%	98%	60%	130%
Methyl tert-butyl Ether	9474716		< 0.004	< 0.004	NA	< 0.004	78%	60%	130%	108%	60%	130%	73%	60%	130%

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Aug 30, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
1,1-Dichloroethane	9474716		< 0.002	< 0.002	NA	< 0.002	109%	60%	130%	94%	60%	130%	98%	60%	130%
Methyl Ethyl Ketone	9474716		< 0.10	< 0.10	NA	< 0.10	91%	60%	130%	101%	60%	130%	84%	60%	130%
CIS 1,2-Dichloroethylene	9474716		< 0.002	< 0.002	NA	< 0.002	95%	60%	130%	88%	60%	130%	80%	60%	130%
Chloroform	9474716		< 0.002	< 0.002	NA	< 0.002	121%	60%	130%	99%	60%	130%	82%	60%	130%
1,2- Dichloroethane	9474716		< 0.002	< 0.002	NA	< 0.002	106%	60%	130%	94%	60%	130%	78%	60%	130%
1,1,1-Trichloroethane	9474716		< 0.002	< 0.002	NA	< 0.002	109%	60%	130%	106%	60%	130%	86%	60%	130%
Carbon Tetrachloride	9474716		< 0.002	< 0.002	NA	< 0.002	107%	60%	130%	87%	60%	130%	91%	60%	130%
Benzene	9474716		< 0.002	< 0.002	NA	< 0.002	106%	60%	130%	108%	60%	130%	89%	60%	130%
1,2-Dichloropropane	9474716		< 0.002	< 0.002	NA	< 0.002	93%	60%	130%	100%	60%	130%	90%	60%	130%
Trichloroethylene	9474716		< 0.004	< 0.004	NA	< 0.004	99%	60%	130%	105%	60%	130%	76%	60%	130%
Bromodichloromethane	9474716		< 0.003	< 0.003	NA	< 0.003	75%	60%	130%	94%	60%	130%	84%	60%	130%
CIS-1,3-Dichloropropene	9474716		< 0.002	< 0.002	NA	< 0.002	87%	60%	130%	84%	60%	130%	77%	60%	130%
Methyl Isobutyl Ketone	9474716		< 0.10	< 0.10	NA	< 0.10	106%	60%	130%	86%	60%	130%	93%	60%	130%
TRANS-1,3-Dichloropropene	9474716		< 0.003	< 0.003	NA	< 0.003	111%	60%	130%	78%	60%	130%	71%	60%	130%
1,1,2-Trichloroethane	9474716		< 0.002	< 0.002	NA	< 0.002	102%	60%	130%	96%	60%	130%	97%	60%	130%
Toluene	9474716		< 0.002	< 0.002	NA	< 0.002	113%	60%	130%	111%	60%	130%	93%	60%	130%
2-Hexanone	9474716		< 0.470	< 0.470	NA	< 0.470	112%	60%	130%	88%	60%	130%	73%	60%	130%
Dibromochloromethane	9474716		< 0.003	< 0.003	NA	< 0.003	104%	60%	130%	81%	60%	130%	80%	60%	130%
Ethylene Dibromide	9474716		< 0.002	< 0.002	NA	< 0.002	92%	60%	130%	94%	60%	130%	80%	60%	130%
Tetrachloroethylene	9474716		< 0.002	< 0.002	NA	< 0.002	108%	60%	130%	98%	60%	130%	85%	60%	130%
1,1,1,2-Tetrachloroethane	9474716		< 0.002	< 0.002	NA	< 0.002	83%	60%	130%	88%	60%	130%	99%	60%	130%
Chlorobenzene	9474716		< 0.002	< 0.002	NA	< 0.002	101%	60%	130%	100%	60%	130%	74%	60%	130%
Ethylbenzene	9474716		< 0.002	< 0.002	NA	< 0.002	110%	60%	130%	99%	60%	130%	92%	60%	130%
m & p-Xylene	9474716		< 0.002	< 0.002	NA	< 0.002	101%	60%	130%	99%	60%	130%	89%	60%	130%
Bromoform	9474716		< 0.002	< 0.002	NA	< 0.002	98%	60%	130%	74%	60%	130%	80%	60%	130%
Styrene	9474716		< 0.002	< 0.002	NA	< 0.002	88%	60%	130%	96%	60%	130%	85%	60%	130%
1,1,2,2- Tetrachloroethane	9474716		< 0.004	< 0.004	NA	< 0.004	82%	60%	130%	92%	60%	130%	83%	60%	130%
o-Xylene	9474716		< 0.002	< 0.002	NA	< 0.002	103%	60%	130%	100%	60%	130%	85%	60%	130%
1,3-Dichlorobenzene	9474716		< 0.002	< 0.002	NA	< 0.002	115%	60%	130%	78%	60%	130%	80%	60%	130%
1,4-Dichlorobenzene	9474716		< 0.002	< 0.002	NA	< 0.002	108%	60%	130%	83%	60%	130%	79%	60%	130%
1,2-Dichlorobenzene	9474716		< 0.002	< 0.002	NA	< 0.002	114%	60%	130%	78%	60%	130%	86%	60%	130%
1,2,4-Trichlorobenzene	9474716		< 0.007	< 0.007	NA	< 0.007	75%	60%	130%	82%	60%	130%	79%	60%	130%
1,3-Dichloropropene (Cis + Trans)	9474716		< 0.002	< 0.002	NA	< 0.002	99%	60%	130%	81%	60%	130%	74%	60%	130%
n-Hexane	9474716		< 0.005	< 0.005	NA	< 0.005	92%	60%	130%	108%	60%	130%	78%	60%	130%

Comments: NA Signifies Not Applicable

Polycyclic Aromatic Hydrocarbons in Soil

1-Methylnaphthalene	1	9484714	< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	72%	50%	140%	73%	50%	140%
2-Methylnaphthalene	1	9484714	< 0.01	< 0.01	NA	< 0.01	95%	50%	140%	72%	50%	140%	82%	50%	140%
Acenaphthene	1	9484714	< 0.00671	< 0.00671	NA	< 0.00671	100%	50%	140%	69%	50%	140%	83%	50%	140%

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.
AGAT WORK ORDER: 18H374254
PROJECT: Port Weller 188083
ATTENTION TO: Rachel Bryan
SAMPLING SITE:
SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Aug 30, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Acenaphthylene	1	9484714	< 0.004	< 0.004	NA	< 0.004	91%	50%	140%	68%	50%	140%	74%	50%	140%
Acridine	1	9484714	< 0.05	< 0.05	NA	< 0.05	79%	50%	140%	58%	50%	140%	55%	50%	140%
Anthracene	1	9484714	< 0.03	< 0.03	NA	< 0.03	84%	50%	140%	60%	50%	140%	65%	50%	140%
Benzo(a)anthracene	1	9484714	< 0.01	< 0.01	NA	< 0.01	92%	50%	140%	74%	50%	140%	75%	50%	140%
Benzo(a)pyrene	1	9484714	< 0.01	< 0.01	NA	< 0.01	82%	50%	140%	85%	50%	140%	68%	50%	140%
Benzo(b)fluoranthene	1	9484714	< 0.05	< 0.05	NA	< 0.05	84%	50%	140%	80%	50%	140%	72%	50%	140%
Benzo(b+j)fluoranthene	1	9484714	< 0.1	< 0.1	NA	< 0.1	91%	50%	140%	90%	50%	140%	80%	50%	140%
Benzo(e)pyrene	1	9484714	< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	87%	50%	140%	75%	50%	140%
Benzo(ghi)perylene	1	9484714	< 0.01	< 0.01	NA	< 0.01	89%	50%	140%	92%	50%	140%	79%	50%	140%
Benzo(k)fluoranthene	1	9484714	< 0.01	< 0.01	NA	< 0.01	63%	50%	140%	73%	50%	140%	65%	50%	140%
Chrysene	1	9484714	< 0.01	< 0.01	NA	< 0.01	92%	50%	140%	73%	50%	140%	74%	50%	140%
Dibenzo(a,h)anthracene	1	9484714	< 0.006	< 0.006	NA	< 0.006	87%	50%	140%	87%	50%	140%	75%	50%	140%
Fluoranthene	1	9484714	< 0.05	< 0.05	NA	< 0.05	82%	50%	140%	66%	50%	140%	73%	50%	140%
Fluorene	1	9484714	< 0.01	< 0.01	NA	< 0.01	99%	50%	140%	70%	50%	140%	83%	50%	140%
Indeno(1,2,3)pyrene	1	9484714	< 0.01	< 0.01	NA	< 0.01	79%	50%	140%	81%	50%	140%	68%	50%	140%
Naphthalene	1	9484714	< 0.01	< 0.01	NA	< 0.01	99%	50%	140%	79%	50%	140%	86%	50%	140%
Perylene	1	9484714	< 0.05	< 0.05	NA	< 0.05	85%	50%	140%	90%	50%	140%	76%	50%	140%
Phenanthrene	1	9484714	< 0.03	< 0.03	NA	< 0.03	95%	50%	140%	72%	50%	140%	78%	50%	140%
Pyrene	1	9484714	< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	67%	50%	140%	75%	50%	140%
Quinoline	1	9484714	< 0.05	< 0.05	NA	< 0.05	88%	50%	140%	70%	50%	140%	70%	50%	140%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Ignitability		EPA SW-846 1030	BURN MOLD
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Tin	MET-93-6103	EPA SW 846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Arsenic Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Barium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Boron Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cadmium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Chromium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Lead Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Mercury Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Selenium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Silver Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Uranium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Fluoride Leachate	INOR-93-6018	EPA SW-846-1311 & SM4500-F- C	ION SELECTIVE ELECTRODE
Cyanide Leachate	INOR-93-6052	EPA SW-846-1311 & MOE 3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
(Nitrate + Nitrite) as N Leachate	INOR-93-6053	EPA SW 846-1311 & SM 4500 - NO3- I	LACHAT FIA

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Toluene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylbenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
m & p-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
o-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Xylene Mixture (Total)	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Moisture Content		MOE E3139	BALANCE
% Moisture		Calculation	GRAVIMETRIC
Benzo(a)pyrene	ORG-91-5114	EPA SW846 3540 & 8270	GC/MS
Vinyl Chloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,1 Dichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Dichloromethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chloroform	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Benzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Trichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
F1 (C6 to C10)	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P &T GC / FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P & T GC / FID
F2 (C10 to C16)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F3 (C16 to C34)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F4 (C34 to C50)	VOL-91-5009	CCME Tier 1 Method	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	Balance
Moisture Content	VOL-91-5009	CCME Tier 1 Method, SW846 5035,8015	BALANCE
Terphenyl	VOL-91-5009	CCME Tier 1 Method	GC/FID
F1 (C6 to C10)	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
F2 (C10 to C16)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
F3 (C16 to C34)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
F4 (C34 to C50)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	BALANCE
Moisture Content	VOL-91-5009	CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009		GC/FID
1-Methylnaphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
2-Methylnaphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acenaphthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acenaphthylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acridine	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(a)anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(a)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(b)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(b+j)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(e)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(ghi)perylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(k)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Chrysene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Dibenzo(a,h)anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Fluorene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Indeno(1,2,3)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Naphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Perylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Phenanthrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Quinoline	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Nitrobenzene-d5	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
2-Fluorobiphenyl	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Terphenyl-d14	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Dichlorodifluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromomethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Acetone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methylene Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
TRANS-1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl tert-butyl Ether	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
CIS 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chloroform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2- Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromodichloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
CIS-1,3-Dichloropropene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
TRANS-1,3-Dichloropropene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
2-Hexanone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Dibromochloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H374254

PROJECT: Port Weller 188083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
1,1,1,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromoform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Styrene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2,2- Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2,4-Trichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichloropropene (Cis + Trans)	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
n-Hexane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: FSH374254

Cooler Quantity: 3 LG coolers

Arrival Temperatures: 6.8 | 6.7 | 6.4

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: DILLON
Contact: RACHEL BRYAN
Address: 130 Dufferin St Suite 1400 London ON
Phone: 519 438 1288 Fax:
Reports to be sent to:
1. Email: rbryan@dillon.ca
2. Email: dburr@dillon.ca

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☒ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

☐ Regulation 558
☒ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
Tier 1 (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: Port Weller 108083
Site Location:
Sampled By: J. Sikorski
AGAT Quote #: PO:
Please note: if quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☒ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Field Filtered - Metals, Hg, CrVI	O. Reg 153: Metals and Inorganics	O. Reg 153: All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides)	O. Reg 153: ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	O. Reg 153: Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_2 ☐ NO_3 ☐ NO_2+NO_3	O. Reg 153: Volatiles: ☐ VOC ☒ BTEX ☐ THM	O. Reg 153: PHCs F1 - F4	O. Reg 153: ABNs	O. Reg 153: PAHs	O. Reg 153: PCBs: ☐ Total ☐ Aroclors	O. Reg 153: Organochlorine Pesticides	O. Reg 153: TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	VOCs
18-1	Aug 15		5	S	Detection limits for PAHs + benzene mvst meet guidelines			X						X	X		X					X
18-2	Aug 15		5					X						X	X		X					
18-3	Aug 15		4											X	X							
18-4	Aug 14		4											X	X							
18-5	Aug 14		4					X							X							X
18-6	Aug 15		4					X						X	X							
18-7	Aug 14		4					X							X							X
18-8	Aug 14		4					X							X							X
18-9	Aug 15		4					X							X							X
18-10	Aug 15		1					X														
18-11	Aug 15		1					X														

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Jamie Lee Sikorski	Aug 15/18	4:30	Daniella JAIC	Aug 15/18	4:30pm

Page 1 of 2

N°: T 071907

Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT

Document ID: Dry-176-153.1.0[D]

Date Issued: March 16, 2018

AGAT Laboratories
5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 18T374254
Cooler Quantity: 3 LG coolers
Arrival Temperatures: 5.9 | 6.1 | 6.3
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes:

Report Information:
Company: DILLON
Contact: Rachel Bryan
Address: 130 Dufferin St Suite 1400 London, ON
Phone: 519-438-1288 Fax:
Reports to be sent to:
1. Email: ~~r bryan~~ rbryan@dillon.ca
2. Email: dbuir@dillon.ca

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)
☐ Regulation 153/04 — Table (Indicate One): ☐ Ind/Com ☐ Res/Park ☐ Agriculture; Soil Texture (Check One): ☐ Coarse ☒ Fine
☐ Sewer Use — ☐ Sanitary ☐ Storm; Region (Indicate One): ☐ MISA
☐ Regulation 558 — ☒ CCME ☐ Prov. Water Quality Objectives (PWQO) ☐ Other: Tier 1 (Indicate One)

Turnaround Time (TAT) Required:
Regular TAT ☒ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
TAT is exclusive of weekends and statutory holidays
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: Port Weller 188083
Site Location: "
Sampled By: J. Silkorski
AGAT Quote #: PO:
Please note: if quotation number is not provided, client will be billed full price for analysis.

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No
Report Guideline on Certificate of Analysis ☐ Yes ☐ No

Invoice Information: Bill To Same: Yes ☐ No ☐
Company:
Contact:
Address:
Email:

Sample Matrix Legend
B Biota; GW Ground Water; O Oil; P Paint; S Soil; SD Sediment; SW Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N
18-12	Aug 15		5	S	Detection	
18-13	Aug 14		5	↓	limits for	
18-14	Aug 14		5	↓	PAHs + Benzene	
18-15	Aug 14		5	↓	must meet	
Deep ON HOLD	Aug 15		4	↓	Requirements	
Shallow ON HOLD	Aug 15		4	↓	guidelines.	

Field Filtered - Metals, Hg, CrVI	O. Reg 153: Metals and Inorganics; All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides); ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN⁻ ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR; Nutrients: ☐ TP ☐ NH₃ ☐ TKN ☐ NO₃ ☐ NO₂ ☐ NO₃+NO₂; Volatiles: ☒ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☒ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Full Metals Scan	Regulation/Custom Metals	TCLP Ignitability
	X	X	X	X	X	X	X						
	X	X	X	X	X	X	X						
	X	X	X	X	X	X	X						
	X	X	X	X	X	X	X						
								X	X	X	X	X	X
								X	X	X	X	X	X

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Jamieree Sikorski	Aug 15/18	4:30	Daniella Jale	Aug 15/18	4:30pm
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page 2 of 2
No: T071908

Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT
Date Issued: March 10, 2018
Document ID: DIV-78-1511-315

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: **DILLON CONSULTING LTD.**
130 Dufferin Avenue
LONDON, ON N6A5R2
(519) 438-6192

ATTENTION TO: **Rachel Bryan**

PROJECT: **Port Weller 18-8083**

AGAT WORK ORDER: **18H375407**

SOIL ANALYSIS REVIEWED BY: **Milithza Silva, Analytical Supervisor (M.Sc. in Analytical Chemistry)**

TRACE ORGANICS REVIEWED BY: **Oksana Gushyla, Trace Organics Lab Supervisor**

WATER ANALYSIS REVIEWED BY: **Milithza Silva, Analytical Supervisor (M.Sc. in Analytical Chemistry)**

DATE REPORTED: **Oct 09, 2018**

PAGES (INCLUDING COVER): **22**

VERSION*: **2**

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

NOTES

VERSION 2:Version 2 supersedes work order 18H375407, Version 1, issued August 30, 2018: The RDL for Cadmium (in water) was revised to 0.015 ug/L.

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Metals & Inorganics (Soil)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

		SAMPLE DESCRIPTION:		GS1	GS2
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2018-08-17	2018-08-17
Parameter	Unit	G / S	RDL	9484220	9484221
Antimony	µg/g	20	0.8	<0.8	<0.8
Arsenic	µg/g	12	1	6	9
Barium	µg/g	500	2	83	63
Beryllium	µg/g	4	0.5	0.6	0.6
Cadmium	µg/g	10	0.5	<0.5	<0.5
Chromium	µg/g	64	2	17	23
Cobalt	µg/g	50	0.5	8.4	11.2
Copper	µg/g	63	1	35	36
Lead	µg/g	140	1	54	**216**
Molybdenum	µg/g	10	0.5	<0.5	<0.5
Nickel	µg/g	50	1	17	21
Selenium	µg/g	1	0.4	<0.4	<0.4
Silver	µg/g	20	0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4
Tin	µg/g	50	1	1	2
Uranium	µg/g	23	0.5	0.6	0.7
Vanadium	µg/g	130	1	23	23
Zinc	µg/g	200	5	119	186
Chromium VI	µg/g	0.4	0.2	<0.2	<0.2
Cyanide	µg/g	0.9	0.040	<0.040	<0.040
Mercury	µg/g		0.10	0.30	1.51
Electrical Conductivity	mS/cm	2	0.005	0.211	0.151
Sodium Adsorption Ratio	NA	5	NA	0.203	0.228
pH, 2:1 CaCl2 Extraction	pH Units	6.0-8.0	NA	7.47	7.45

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME 2008 (R/P,F)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9484220-9484221 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Militza O. Silva

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

VOCs (Water)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

SAMPLE DESCRIPTION:				18-5	18-10		18-8		18-13
SAMPLE TYPE:				Water	Water		Water		Water
DATE SAMPLED:				2018-08-17	2018-08-17		2018-08-17		2018-08-17
Parameter	Unit	G / S	RDL	9484178	9484185	RDL	9484186	RDL	9484219
Dichlorodifluoromethane	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Vinyl Chloride	µg/L		0.34	<0.34	<0.34	1.70	<1.70	0.34	<0.34
Bromomethane	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Trichlorofluoromethane	µg/L		0.80	<0.80	<0.80	4.00	<4.00	0.80	<0.80
Acetone	µg/L		2.0	<2.0	<2.0	10.0	<10.0	2.0	<2.0
1,1-Dichloroethylene	µg/L		0.60	<0.60	<0.60	3.00	<3.00	0.60	<0.60
Methylene Chloride	µg/L	98.1	0.60	<0.60	<0.60	3.00	<3.00	0.60	<0.60
trans- 1,2-Dichloroethylene	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Methyl tert-butyl ether	µg/L	10000	0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
1,1-Dichloroethane	µg/L		0.60	<0.60	<0.60	3.00	<3.00	0.60	<0.60
Methyl Ethyl Ketone	µg/L		2.0	<2.0	<2.0	10.0	<10.0	2.0	<2.0
cis- 1,2-Dichloroethylene	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Chloroform	µg/L	1.8	0.40	<0.40	<0.40	1.80	<1.80	0.40	<0.40
1,2-Dichloroethane	µg/L	100	0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
1,1,1-Trichloroethane	µg/L		0.60	<0.60	<0.60	3.00	<3.00	0.60	<0.60
Carbon Tetrachloride	µg/L	13.3	0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Benzene	µg/L	370	0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
1,2-Dichloropropane	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Trichloroethylene	µg/L	21	0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Bromodichloromethane	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Methyl Isobutyl Ketone	µg/L		2.0	<2.0	<2.0	10.0	<10.0	2.0	<2.0
1,1,2-Trichloroethane	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Toluene	µg/L	2.0	0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Dibromochloromethane	µg/L		0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
Ethylene Dibromide	µg/L		0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
Tetrachloroethylene	µg/L	110	0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
1,1,1,2-Tetrachloroethane	µg/L		0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
Chlorobenzene	µg/L	1.3	0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
Ethylbenzene	µg/L	90	0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
m & p-Xylene	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

VOCs (Water)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

		SAMPLE DESCRIPTION:		18-5	18-10		18-8		18-13
		SAMPLE TYPE:		Water	Water		Water		Water
		DATE SAMPLED:		2018-08-17	2018-08-17		2018-08-17		2018-08-17
Parameter	**Unit**	**G / S**	**RDL**	**9484178**	**9484185**	**RDL**	**9484186**	**RDL**	**9484219**
Bromoform	µg/L		0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
Styrene	µg/L	72	0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
1,1,2,2-Tetrachloroethane	µg/L		0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
o-Xylene	µg/L		0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
1,3-Dichlorobenzene	µg/L	150	0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
1,4-Dichlorobenzene	µg/L	26	0.20	<0.20	<0.20	1.00	<1.00	0.20	<0.20
1,2-Dichlorobenzene	µg/L	0.70	0.20	<0.20	<0.20	0.70	<0.70	0.20	<0.20
1,3-Dichloropropene	µg/L		0.60	<0.60	<0.60	3.00	<3.00	0.60	<0.60
Xylene Mixture	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
n-Hexane	µg/L		0.40	<0.40	<0.40	2.00	<2.00	0.40	<0.40
Surrogate	**Unit**	**Acceptable Limits**							
Toluene-d8	% Recovery	50-140		102	97		102		103
4-Bromofluorobenzene	% Recovery	50-140		119	106		99		99

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME FWAL - depends on pH* or hardness**
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9484178-9484185 Dilution factor=2
The sample was diluted because it was foamy. The reporting detection limit has been corrected for the dilution factor used.

9484186 Dilution factor=10
The sample was diluted because it was foamy. The reporting detection limit has been corrected for the dilution factor used.

9484219 Dilution factor=2
The sample was diluted due to the large amount of settled soil in the sample vial, there was limited water available to perform the analysis. The reporting detection limit has been corrected for the dilution factor used.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (Water)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

		SAMPLE DESCRIPTION:		18-4
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2018-08-17
Parameter	**Unit**	**G / S**	**RDL**	**9484175**
Benzene	µg/L	370	0.20	<0.20
Toluene	µg/L	2.0	0.20	<0.20
Ethylbenzene	µg/L	90	0.10	<0.10
Xylene Mixture	µg/L		0.20	<0.20
F1 (C6 - C10)	µg/L		25	<25
F1 (C6 to C10) minus BTEX	µg/L		25	<25
F2 (C10 to C16)	µg/L		100	<100
F3 (C16 to C34)	µg/L		100	<100
F4 (C34 to C50)	µg/L		100	<100
Gravimetric Heavy Hydrocarbons	µg/L		500	NA
Surrogate	**Unit**	**Acceptable Limits**		
Terphenyl	%	60-140		81

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME FWAL - depends on pH* or hardness**
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9484175 The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6-C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153/04, results are considered valid without determining the PAH contribution if not requested by the client.
NA = Not Applicable

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PHCs F1 (-BTEX) (Water)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

		SAMPLE DESCRIPTION:		18-13
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2018-08-17
Parameter	Unit	G / S	RDL	9484219
F1 (C6 - C10)	µg/L		25	<25
F1 (C6 to C10) minus BTEX	µg/L		25	<25

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9484219 The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6-C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PHCs F1 - F4 (-BTEX) (Water)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

		SAMPLE DESCRIPTION:		18-5	18-10	18-8
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-08-17	2018-08-17	2018-08-17
Parameter	**Unit**	**G / S**	**RDL**	**9484178**	**9484185**	**9484186**
F1 (C6 - C10)	µg/L		25	<25	<25	<25
F1 (C6 to C10) minus BTEX	µg/L		25	<25	<25	<25
F2 (C10 to C16)	µg/L		100	<100	<100	<100
F3 (C16 to C34)	µg/L		100	<100	<100	<100
F4 (C34 to C50)	µg/L		100	<100	<100	<100
Gravimetric Heavy Hydrocarbons	µg/L		500	NA	NA	NA
Surrogate	**Unit**	**Acceptable Limits**				
Terphenyl	%	60-140		70	92	77

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9484178-9484186 The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6-C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Polycyclic Aromatic Hydrocarbons in Water - (PAH)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

		SAMPLE DESCRIPTION:		BH16
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2018-08-17
Parameter	**Unit**	**G / S**	**RDL**	**9484531**
1-Methylnaphthalene	ug/L		0.01	<0.01
2-Methylnaphthalene	ug/L		0.01	<0.01
Acenaphthene	ug/L	5.8	0.01	<0.01
Acenaphthylene	ug/L		0.01	<0.01
Acridine	ug/L	4.4	0.01	<0.01
Anthracene	ug/L	0.012	0.012	<0.012
Benzo(a)anthracene	ug/L	0.018	0.018	<0.018
Benzo(a)pyrene	ug/L	0.015	0.010	<0.010
Benzo(b)fluoranthene	ug/L		0.01	<0.01
Benzo(e)pyrene	ug/L		0.01	<0.01
Benzo(ghi)perylene	ug/L		0.01	<0.01
Benzo(k)fluoranthene	ug/L		0.01	<0.01
Chrysene	ug/L		0.01	<0.01
Dibenzo(a,h)anthracene	ug/L		0.01	<0.01
Fluoranthene	ug/L	0.04	0.01	<0.01
Fluorene	ug/L	3.0	0.01	<0.01
Indeno(1,2,3-cd)pyrene	ug/L		0.01	<0.01
Naphthalene	ug/L	1.1	0.01	<0.01
Perylene	ug/L		0.01	<0.01
Phenanthrene	ug/L	0.4	0.01	<0.01
Pyrene	ug/L	0.025	0.01	<0.01
Quinoline	ug/L	3.4	0.01	<0.01
Surrogate	**Unit**	**Acceptable Limits**		
Nitrobenzene-d5	%	50-140		85
2-Fluorobiphenyl	%	50-140		68
Terphenyl-d14	%	50-140		79

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Polycyclic Aromatic Hydrocarbons in Water - (PAH)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME(FWAL) ug/L
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9484531 Benzo(b)fluoranthene may include contributions from benzo(j)fluoranthene, if also present in the sample.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Metals & Inorganics (Water)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

SAMPLE DESCRIPTION:				18-5	18-10	18-8		18-13		BH16
SAMPLE TYPE:				Water	Water	Water		Water		Water
DATE SAMPLED:				2018-08-17	2018-08-17	2018-08-17		2018-08-17		2018-08-17
Parameter	Unit	G / S	RDL	9484178	9484185	9484186	RDL	9484219	RDL	9484531
Aluminum	µg/L	*	4.0	77.6	12.0	470	4.0	447	4.0	12.0
Antimony	µg/L		1.0	<1.0	<1.0	<1.0	1.0	<1.0	1.0	<1.0
Arsenic	µg/L	5	1.0	2.0	1.8	1.1	1.0	<1.0	1.0	1.5
Barium	µg/L		2.0	111	123	42.3	2.0	35.4	2.0	23.1
Beryllium	µg/L		0.5	<0.5	<0.5	<0.5	0.5	<0.5	0.5	<0.5
Boron	µg/L	1500	10.0	465	469	237	10.0	253	10.0	333
Cadmium	µg/L	0.09	0.015	0.051	0.023	**0.130**	0.015	0.047	0.015	0.027
Chromium	µg/L		2.0	4.0	4.0	2.5	2.0	<2.0	2.0	3.4
Cobalt	µg/L		0.5	5.7	5.7	5.8	0.5	3.2	0.5	9.7
Copper	µg/L	**	1.0	4.4	3.7	13.7	1.0	5.8	1.0	2.9
Iron	µg/L	300	10.0	95.3	<10.0	**565**	10.0	**525**	10.0	**3010**
Lead	µg/L	**	0.5	2.5	<0.5	2.8	0.5	<0.5	0.5	<0.5
Molybdenum	µg/L	73	0.5	5.8	6.1	0.9	0.5	12.3	0.5	0.7
Nickel	µg/L	**	1.0	3.6	3.1	9.5	1.0	5.2	1.0	3.8
Selenium	µg/L	1.0	1.0	**1.1**	**1.2**	<1.0	1.0	<1.0	1.0	<1.0
Silver	µg/L	0.25	0.2	<0.2	<0.2	<0.2	0.2	<0.2	0.2	<0.2
Thallium	µg/L	0.8	0.3	<0.3	<0.3	<0.3	0.3	<0.3	0.3	<0.3
Uranium	µg/L	15	0.5	11.9	12.8	**17.4**	0.5	5.8	0.5	14.8
Vanadium	µg/L		0.4	1.1	1.2	1.8	0.4	1.9	0.4	0.7
Zinc	µg/L	30	5.0	20.3	19.3	**119**	5.0	11.0	5.0	12.9
Mercury	µg/L	0.026	0.02	<0.02	<0.02	<0.02	0.02	ISQ	0.02	<0.02
Chromium VI	µg/L	1	1	<1	<1	<1	1	ISQ	1	<1
Cyanide	µg/L	5	2	<2	<2	<2	2	<2	2	<2
Chloride	µg/L		2000	378000	369000	162000	500	99900	4000	193000
pH	pH Units		NA	7.74	7.75	7.59	NA	7.99	NA	7.71

Certified By: Militza O. Silva

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Metals & Inorganics (Water)

DATE RECEIVED: 2018-08-20

DATE REPORTED: 2018-10-09

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON CCME FWAL - depends on pH* or hardness**
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9484178 Elevated RDL indicates the degree of sample dilution prior to the analysis in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.
Cadmium analysis: Value is at or greater than calculated MDL (Method Detection Limit) but below RDL (Reported Detection Limit). It is a tentative low-level result.

9484185-9484186 Elevated RDL indicates the degree of sample dilution prior to the analysis in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.
Cadmium analysis: Value is at or greater than calculated MDL (Method Detection Limit) but below RDL (Reported Detection Limit). It is a tentative low-level result.

9484219 Elevated RDL indicates the degree of sample dilution prior to the analysis in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.
Cadmium analysis: Value is at or greater than calculated MDL (Method Detection Limit) but below RDL (Reported Detection Limit). It is a tentative low-level result.
ISQ: Insufficient Sample Quantity

9484531 Elevated RDL indicates the degree of sample dilution prior to the analysis in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.
Cadmium analysis: Value is at or greater than calculated MDL (Method Detection Limit) but below RDL (Reported Detection Limit). It is a tentative low-level result.

2018 Oct 5 Revision: This report replaces the Certificate of Analysis issued on 2018 Aug 30. The RDL for Cadmium was revised to comply with the required regulatory standards and the results were corrected accordingly.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Militsa O. Silva

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Guideline Violation

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

CLIENT NAME: DILLON CONSULTING LTD.

ATTENTION TO: Rachel Bryan

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
9484178	18-5	ON CCME FWAL	Metals & Inorganics (Water)	Selenium	µg/L	1.0	1.1
9484185	18-10	ON CCME FWAL	Metals & Inorganics (Water)	Selenium	µg/L	1.0	1.2
9484186	18-8	ON CCME FWAL	Metals & Inorganics (Water)	Cadmium	µg/L	0.09	0.130
9484186	18-8	ON CCME FWAL	Metals & Inorganics (Water)	Iron	µg/L	300	565
9484186	18-8	ON CCME FWAL	Metals & Inorganics (Water)	Uranium	µg/L	15	17.4
9484186	18-8	ON CCME FWAL	Metals & Inorganics (Water)	Zinc	µg/L	30	119
9484219	18-13	ON CCME FWAL	Metals & Inorganics (Water)	Iron	µg/L	300	525
9484221	GS2	ON CCME 2008 (R/P,F)	Metals & Inorganics (Soil)	Lead	µg/g	140	216
9484531	BH16	ON CCME FWAL	Metals & Inorganics (Water)	Iron	µg/L	300	3010

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Oct 09, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Metals & Inorganics (Soil)															
Antimony	9488816		<0.8	<0.8	NA	< 0.8	126%	70%	130%	89%	80%	120%	81%	70%	130%
Arsenic	9488816		4	4	NA	< 1	113%	70%	130%	101%	80%	120%	105%	70%	130%
Barium	9488816		157	145	7.9%	< 2	98%	70%	130%	104%	80%	120%	89%	70%	130%
Beryllium	9488816		0.7	0.8	NA	< 0.5	75%	70%	130%	95%	80%	120%	80%	70%	130%
Cadmium	9488816		<0.5	<0.5	NA	< 0.5	106%	70%	130%	95%	80%	120%	94%	70%	130%
Chromium	9488816		29	26	10.9%	< 2	94%	70%	130%	101%	80%	120%	101%	70%	130%
Cobalt	9488816		12.0	11.0	8.7%	< 0.5	117%	70%	130%	96%	80%	120%	96%	70%	130%
Copper	9488816		24	20	18.2%	< 1	102%	70%	130%	104%	80%	120%	96%	70%	130%
Lead	9488816		19	18	5.4%	< 1	104%	70%	130%	104%	80%	120%	100%	70%	130%
Molybdenum	9488816		0.8	0.9	NA	< 0.5	121%	70%	130%	95%	80%	120%	106%	70%	130%
Nickel	9488816		24	25	4.1%	< 1	118%	70%	130%	93%	80%	120%	83%	70%	130%
Selenium	9488816		0.6	0.4	NA	< 0.4	98%	70%	130%	101%	80%	120%	103%	70%	130%
Silver	9488816		<0.2	<0.2	NA	< 0.2	113%	70%	130%	97%	80%	120%	96%	70%	130%
Thallium	9488816		<0.4	<0.4	NA	< 0.4	105%	70%	130%	94%	80%	120%	91%	70%	130%
Tin	1948881		< 1	1	NA	< 1	106%	70%	130%	113%	80%	120%	108%	70%	130%
Uranium	9488816		0.9	0.8	NA	< 0.5	116%	70%	130%	109%	80%	120%	107%	70%	130%
Vanadium	9488816		40	39	2.5%	< 1	109%	70%	130%	96%	80%	120%	82%	70%	130%
Zinc	9488816		88	88	0.0%	< 5	108%	70%	130%	101%	80%	120%	88%	70%	130%
Chromium VI	9489780		<0.2	<0.2	NA	< 0.2	74%	70%	130%	99%	80%	120%	93%	70%	130%
Cyanide	9488493		<0.040	<0.040	NA	< 0.040	106%	70%	130%	95%	80%	120%	108%	70%	130%
Mercury	9488816		<0.10	<0.10	NA	< 0.10	104%	70%	130%	106%	80%	120%	101%	70%	130%
Electrical Conductivity	9483644		10.8	10.8	0.0%	< 0.005	97%	90%	110%	NA			NA		
Sodium Adsorption Ratio	9488324		0.499	0.482	3.5%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	9484233		7.76	7.70	0.8%	NA	100%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Militthza O. Silva

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Oct 09, 2018

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
VOCs (Water)															
Dichlorodifluoromethane	9487858		< 0.20	< 0.20	NA	< 0.20	112%	50%	140%	112%	50%	140%	112%	50%	140%
Vinyl Chloride	9487858		< 0.17	< 0.17	NA	< 0.17	108%	50%	140%	79%	50%	140%	107%	50%	140%
Bromomethane	9487858		< 0.20	< 0.20	NA	< 0.20	73%	50%	140%	110%	50%	140%	77%	50%	140%
Trichlorofluoromethane	9487858		< 0.40	< 0.40	NA	< 0.40	116%	50%	140%	119%	50%	140%	110%	50%	140%
Acetone	9487858		< 1.0	< 1.0	NA	< 1.0	102%	50%	140%	107%	50%	140%	105%	50%	140%
1,1-Dichloroethylene	9487858		< 0.30	< 0.30	NA	< 0.30	101%	50%	140%	101%	60%	130%	117%	50%	140%
Methylene Chloride	9487858		< 0.30	< 0.30	NA	< 0.30	117%	50%	140%	116%	60%	130%	94%	50%	140%
trans- 1,2-Dichloroethylene	9487858		< 0.20	< 0.20	NA	< 0.20	90%	50%	140%	111%	60%	130%	109%	50%	140%
Methyl tert-butyl ether	9487858		< 0.20	< 0.20	NA	< 0.20	108%	50%	140%	117%	60%	130%	106%	50%	140%
1,1-Dichloroethane	9487858		< 0.30	< 0.30	NA	< 0.30	81%	50%	140%	104%	60%	130%	103%	50%	140%
Methyl Ethyl Ketone	9487858		< 1.0	< 1.0	NA	< 1.0	107%	50%	140%	110%	50%	140%	116%	50%	140%
cis- 1,2-Dichloroethylene	9487858		< 0.20	< 0.20	NA	< 0.20	73%	50%	140%	77%	60%	130%	78%	50%	140%
Chloroform	9487858		< 0.20	< 0.20	NA	< 0.20	87%	50%	140%	91%	60%	130%	79%	50%	140%
1,2-Dichloroethane	9487858		< 0.20	< 0.20	NA	< 0.20	78%	50%	140%	84%	60%	130%	106%	50%	140%
1,1,1-Trichloroethane	9487858		< 0.30	< 0.30	NA	< 0.30	88%	50%	140%	109%	60%	130%	100%	50%	140%
Carbon Tetrachloride	9487858		< 0.20	< 0.20	NA	< 0.20	84%	50%	140%	86%	60%	130%	100%	50%	140%
Benzene	9487858		< 0.20	< 0.20	NA	< 0.20	74%	50%	140%	78%	60%	130%	115%	50%	140%
1,2-Dichloropropane	9487858		< 0.20	< 0.20	NA	< 0.20	96%	50%	140%	100%	60%	130%	105%	50%	140%
Trichloroethylene	9487858		< 0.20	< 0.20	NA	< 0.20	88%	50%	140%	89%	60%	130%	84%	50%	140%
Bromodichloromethane	9487858		< 0.20	< 0.20	NA	< 0.20	92%	50%	140%	98%	60%	130%	89%	50%	140%
Methyl Isobutyl Ketone	9487858		< 1.0	< 1.0	NA	< 1.0	107%	50%	140%	105%	50%	140%	112%	50%	140%
1,1,2-Trichloroethane	9487858		< 0.20	< 0.20	NA	< 0.20	110%	50%	140%	114%	60%	130%	113%	50%	140%
Toluene	9487858		< 0.20	< 0.20	NA	< 0.20	108%	50%	140%	104%	60%	130%	111%	50%	140%
Dibromochloromethane	9487858		< 0.10	< 0.10	NA	< 0.10	113%	50%	140%	117%	60%	130%	116%	50%	140%
Ethylene Dibromide	9487858		< 0.10	< 0.10	NA	< 0.10	110%	50%	140%	106%	60%	130%	110%	50%	140%
Tetrachloroethylene	9487858		< 0.20	< 0.20	NA	< 0.20	117%	50%	140%	116%	60%	130%	118%	50%	140%
1,1,1,2-Tetrachloroethane	9487858		< 0.10	< 0.10	NA	< 0.10	103%	50%	140%	104%	60%	130%	105%	50%	140%
Chlorobenzene	9487858		< 0.10	< 0.10	NA	< 0.10	111%	50%	140%	111%	60%	130%	114%	50%	140%
Ethylbenzene	9487858		< 0.10	< 0.10	NA	< 0.10	115%	50%	140%	111%	60%	130%	110%	50%	140%
m & p-Xylene	9487858		< 0.20	< 0.20	NA	< 0.20	111%	50%	140%	113%	60%	130%	114%	50%	140%
Bromoform	9487858		< 0.10	< 0.10	NA	< 0.10	102%	50%	140%	106%	60%	130%	105%	50%	140%
Styrene	9487858		< 0.10	< 0.10	NA	< 0.10	102%	50%	140%	105%	60%	130%	99%	50%	140%
1,1,2,2-Tetrachloroethane	9487858		< 0.10	< 0.10	NA	< 0.10	105%	50%	140%	111%	60%	130%	110%	50%	140%
o-Xylene	9487858		< 0.10	< 0.10	NA	< 0.10	104%	50%	140%	118%	60%	130%	116%	50%	140%
1,3-Dichlorobenzene	9487858		< 0.10	< 0.10	NA	< 0.10	103%	50%	140%	119%	60%	130%	113%	50%	140%
1,4-Dichlorobenzene	9487858		< 0.10	< 0.10	NA	< 0.10	112%	50%	140%	108%	60%	130%	107%	50%	140%
1,2-Dichlorobenzene	9487858		< 0.10	< 0.10	NA	< 0.10	116%	50%	140%	119%	60%	130%	101%	50%	140%
1,3-Dichloropropene	9487858		< 0.30	< 0.30	NA	< 0.30	102%	50%	140%	109%	60%	130%	112%	50%	140%
n-Hexane	9487858		< 0.20	< 0.20	NA	< 0.20	113%	50%	140%	100%	60%	130%	112%	50%	140%

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.
AGAT WORK ORDER: 18H375407
PROJECT: Port Weller 18-8083
ATTENTION TO: Rachel Bryan
SAMPLING SITE:
SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Oct 09, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Polycyclic Aromatic Hydrocarbons in Water - (PAH)															
1-Methylnaphthalene	1	9496313	0.01	0.01	0	< 0.01	102%	50%	140%	71%	50%	140%	78%	50%	140%
2-Methylnaphthalene	1	9496313	0.02	0.01	67	< 0.01	100%	50%	140%	72%	50%	140%	79%	50%	140%
Acenaphthene	1	9496313	0.01	0.01	0	< 0.01	96%	50%	140%	64%	50%	140%	56%	50%	140%
Acenaphthylene	1	9496313	<0.01	<0.01	0	< 0.01	102%	50%	140%	67%	50%	140%	64%	50%	140%
Acridine	1	9496313	<0.01	<0.01	0	< 0.01	85%	50%	140%	73%	50%	140%	78%	50%	140%
Anthracene	1	9496313	<0.012	<0.012	0	< 0.012	95%	50%	140%	69%	50%	140%	73%	50%	140%
Benzo(a)anthracene	1	9496313	<0.018	<0.018	0	< 0.018	104%	50%	140%	70%	50%	140%	67%	50%	140%
Benzo(a)pyrene	1	9496313	<0.015	<0.015	0	< 0.010	74%	50%	140%	56%	50%	140%	60%	50%	140%
Benzo(b)fluoranthene	1	9496313	<0.01	<0.01	0	< 0.01	77%	50%	140%	63%	50%	140%	64%	50%	140%
Benzo(e)pyrene	1	9496313	<0.01	<0.01	0	< 0.01	73%	50%	140%	53%	50%	140%	58%	50%	140%
Benzo(ghi)perylene	1	9496313	<0.01	<0.01	0	< 0.01	83%	50%	140%	59%	50%	140%	60%	50%	140%
Benzo(k)fluoranthene	1	9496313	<0.01	<0.01	0	< 0.01	65%	50%	140%	71%	50%	140%	58%	50%	140%
Chrysene	1	9496313	<0.01	<0.01	0	< 0.01	95%	50%	140%	63%	50%	140%	61%	50%	140%
Dibenzo(a,h)anthracene	1	9496313	<0.01	<0.01	0	< 0.01	83%	50%	140%	65%	50%	140%	66%	50%	140%
Fluoranthene	1	9496313	0.01	0.01	0	< 0.01	99%	50%	140%	71%	50%	140%	74%	50%	140%
Fluorene	1	9496313	<0.01	<0.01	0	< 0.01	97%	50%	140%	67%	50%	140%	67%	50%	140%
Indeno(1,2,3-cd)pyrene	1	9496313	<0.01	<0.01	0	< 0.01	83%	50%	140%	64%	50%	140%	63%	50%	140%
Naphthalene	1	9496313	0.06	0.06	0	< 0.01	99%	50%	140%	67%	50%	140%	74%	50%	140%
Perylene	1	9496313	<0.01	<0.01	0	< 0.01	72%	50%	140%	53%	50%	140%	57%	50%	140%
Phenanthrene	1	9496313	0.01	0.01	0	< 0.01	93%	50%	140%	63%	50%	140%	67%	50%	140%
Pyrene	1	9496313	<0.01	0.01	0	< 0.01	99%	50%	140%	70%	50%	140%	73%	50%	140%
Quinoline	1	9496313	<0.01	<0.01	0	< 0.01	97%	50%	140%	63%	50%	140%	74%	50%	140%
Nitrobenzene-d5	1	9496313	53	<0	0	<									
2-Fluorobiphenyl	1	9496313	51	<0	0	<									
Terphenyl-d14	1	9496313	65	<0	0	<									

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

O. Reg. 153(511) - PHCs F1 - F4 (Water)															
Benzene	9481098		< 0.20	< 0.20	NA	< 0.20	105%	50%	140%	107%	60%	130%	105%	50%	140%
Toluene	9481098		< 0.20	< 0.20	NA	< 0.20	105%	50%	140%	118%	60%	130%	96%	50%	140%
Ethylbenzene	9481098		< 0.10	< 0.10	NA	< 0.10	94%	50%	140%	107%	60%	130%	106%	50%	140%
Xylene Mixture	9481098		< 0.20	< 0.20	NA	< 0.20	94%	50%	140%	104%	60%	130%	94%	50%	140%
F1 (C6 - C10)	9481098		< 25	< 25	NA	< 25	117%	60%	140%	102%	60%	140%	115%	60%	140%
F2 (C10 to C16)		TW	< 100	< 100	NA	< 100	107%	60%	140%	65%	60%	140%	60%	60%	140%
F3 (C16 to C34)		TW	< 100	< 100	NA	< 100	112%	60%	140%	75%	60%	140%	77%	60%	140%
F4 (C34 to C50)		TW	< 100	< 100	NA	< 100	97%	60%	140%	85%	60%	140%	82%	60%	140%

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Oct 09, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: Tap water analysis has been performed as QC sample testing for duplicate and matrix spike due to insufficient sample volume.
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Oct 09, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Metals & Inorganics (Water)															
Aluminum	9486073		689	646	6.4%	< 4.0	101%	90%	110%	101%	90%	110%	100%	70%	130%
Antimony	9486073		<1.0	<1.0	NA	< 1.0	101%	70%	130%	104%	80%	120%	105%	70%	130%
Arsenic	9486073		<1.0	<1.0	NA	< 1.0	100%	70%	130%	99%	80%	120%	112%	70%	130%
Barium	9486073		13.1	12.7	3.1%	< 2.0	100%	70%	130%	99%	80%	120%	94%	70%	130%
Beryllium	9486073		<0.5	<0.5	NA	< 0.5	99%	70%	130%	102%	80%	120%	115%	70%	130%
Boron	9486073		<10.0	10.7	NA	< 10.0	103%	70%	130%	100%	80%	120%	106%	70%	130%
Cadmium	9486073		0.053	0.060	NA	< 0.015	99%	70%	130%	102%	80%	120%	105%	70%	130%
Chromium	9486073		<2.0	<2.0	NA	< 2.0	95%	70%	130%	101%	80%	120%	99%	70%	130%
Cobalt	9486073		0.8	0.7	NA	< 0.5	105%	70%	130%	110%	80%	120%	109%	70%	130%
Copper	9486073		232	221	4.9%	< 1.0	101%	70%	130%	106%	80%	120%	102%	70%	130%
Iron	9486073		90.4	80.2	12.0%	< 10.0	102%	90%	110%	98%	90%	110%	97%	70%	130%
Lead	9486073		23.6	23.0	2.6%	< 0.5	100%	70%	130%	100%	80%	120%	95%	70%	130%
Molybdenum	9486073		<0.5	<0.5	NA	< 0.5	97%	70%	130%	96%	80%	120%	94%	70%	130%
Nickel	9486073		1.4	1.3	NA	< 1.0	103%	70%	130%	108%	80%	120%	106%	70%	130%
Selenium	9486073		<1.0	<1.0	NA	< 1.0	101%	70%	130%	103%	80%	120%	121%	70%	130%
Silver	9486073		<0.2	<0.2	NA	< 0.2	107%	70%	130%	109%	80%	120%	107%	70%	130%
Thallium	9486073		<0.3	<0.3	NA	< 0.3	102%	70%	130%	106%	80%	120%	100%	70%	130%
Uranium	9486073		<0.5	<0.5	NA	< 0.5	98%	70%	130%	96%	80%	120%	95%	70%	130%
Vanadium	9486073		<0.4	<0.4	NA	< 0.4	103%	70%	130%	107%	80%	120%	108%	70%	130%
Zinc	9486073		258	261	1.2%	< 5.0	99%	70%	130%	103%	80%	120%	114%	70%	130%
Mercury	9488116		<0.02	<0.02	NA	< 0.02	105%	70%	130%	105%	80%	120%	96%	70%	130%
Chromium VI	9484178	9484178	<1	<1	NA	< 1	101%	90%	110%	104%	90%	110%	103%	70%	130%
Cyanide	9484178	9484178	<2	<2	NA	< 2	106%	70%	130%	97%	80%	120%	101%	70%	130%
Chloride	9493202		92800	92100	0.8%	< 100	102%	70%	130%	109%	70%	130%	108%	70%	130%
pH	9495721		8.01	8.06	0.6%	NA	100%	90%	110%						

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Militthza O. Silva

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Tin	MET-93-6103	EPA SW 846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Dichlorodifluoromethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Bromomethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Acetone	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
trans- 1,2-Dichloroethylene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Methyl tert-butyl ether	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Chloroform	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Benzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Bromodichloromethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Toluene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Dibromochloromethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Bromoform	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Styrene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
o-Xylene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Xylene Mixture	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
n-Hexane	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Benzene	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
Toluene	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
Ethylbenzene	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
Xylene Mixture	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
F1 (C6 - C10)	VOL-91- 5010	MOE PHC-E3421	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
F2 (C10 to C16)	VOL-91-5010	MOE PHC-E3421	GC/FID

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
F3 (C16 to C34)	VOL-91-5010	MOE PHC-E3421	GC/FID
F4 (C34 to C50)	VOL-91-5010	MOE PHC-E3421	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	MOE PHC-E3421	BALANCE
Terphenyl	VOL-91-5010		GC/FID
F1 (C6 - C10)	VOL-91- 5010	MOE PHC E3421	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5010	MOE PHC E3421	(P&T)GC/FID
F2 (C10 to C16)	VOL-91-5010	MOE PHC E3421	GC / FID
F3 (C16 to C34)	VOL-91-5010	MOE PHC E3421	GC / FID
F4 (C34 to C50)	VOL-91-5010	MOE PHC E3421	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	MOE PHC E3421	BALANCE
1-Methylnaphthalene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
2-Methylnaphthalene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Acenaphthene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Acenaphthylene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Acridine	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Anthracene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Benzo(a)anthracene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Benzo(a)pyrene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Benzo(b)fluoranthene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Benzo(e)pyrene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Benzo(ghi)perylene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Benzo(k)fluoranthene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Chrysene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Dibenzo(a,h)anthracene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Fluoranthene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Fluorene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Naphthalene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Perylene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Phenanthrene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Pyrene	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Quinoline	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Nitrobenzene-d5	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
2-Fluorobiphenyl	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Terphenyl-d14	ORG-120-5104	EPA SW846/3510/8270C	GC/MS

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: DILLON CONSULTING LTD.

AGAT WORK ORDER: 18H375407

PROJECT: Port Weller 18-8083

ATTENTION TO: Rachel Bryan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Aluminum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Antimony	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Barium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW-846 7470 & 245.1	CVAAS
Molybdenum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Selenium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Silver	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Thallium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Uranium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium VI	INOR-93-6034	SM 3500-Cr B	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE METHOD CN- 3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Laboratory Use Only

Work Order #: 18H375407
Cooler Quantity: 2 L6
Arrival Temperatures: 9.9 | 9.8 | 9.7
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: Cooler #2 8.9 | 9.0 | 9.1

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Dillon Consulting
Contact: Rachel Bryan, Darin Burr
Address: 130 Dufferin Ave Suite 1400 London, ON
Phone: Fax:
Reports to be sent to:
1. Email: rbryan@dillon.ca
2. Email: ~~dburr@dillon.ca~~ d.burr@dillon.ca

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One): ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☐ Coarse ☒ Fine
☐ Sewer Use: ☐ Sanitary ☐ Storm
Region (Indicate One)
☐ MISA
☒ ~~Regulation 558~~
☒ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
Tier 1 (Indicate One)

Is this submission for a **Record of Site Condition**? ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: ~~Port~~ Port Weller 18-8083
Site Location: Port Weller
Sampled By: J. Sikorski
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☒ No ☐
Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	Metals and Inorganics	☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH₃ ☐ TKN ☐ NO₃ ☐ NO₂ ☐ NO₃+NO₂	Volatiles: ☐ VOC ☒ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	VOCs
18-4	Aug 17		4	GW									X	X							
18-5	Aug 17		12	GW	limited water in PAHs Amber		X							X		X					X
18-10	Aug 17		13	GW	"		X							X		X					X
18-8	Aug 17		12	GW			X						[scribbled out]	X							X
18-13	Aug 17		13	GW	limited water try and get what is possible		X							X		X					X
GS1	Aug 17		1	Soil	Also very silty.		X														
GS2	Aug 17		1	Soil			X														
BH16	Aug 17		6	GW			X									X					

Samples Relinquished By (Print Name and Sign): Jamielee Sikorski [signature]	Date: Aug 17/18	Time: 5:20	Samples Received By (Print Name and Sign): Daniella Jaic [signature]	Date: Aug 17/18	Time: 5:25pm
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

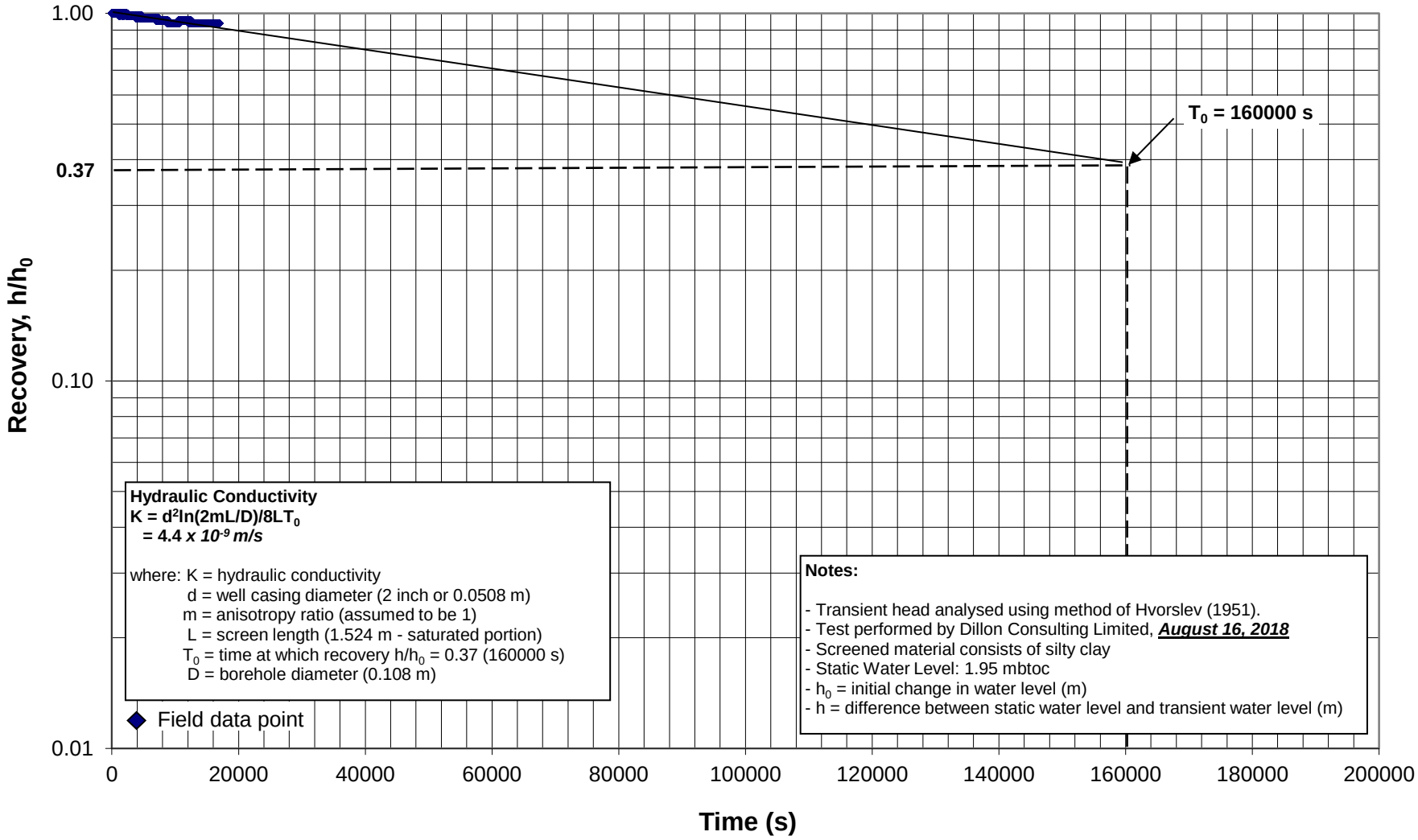
Page 1 of 1

Nº: T 072746

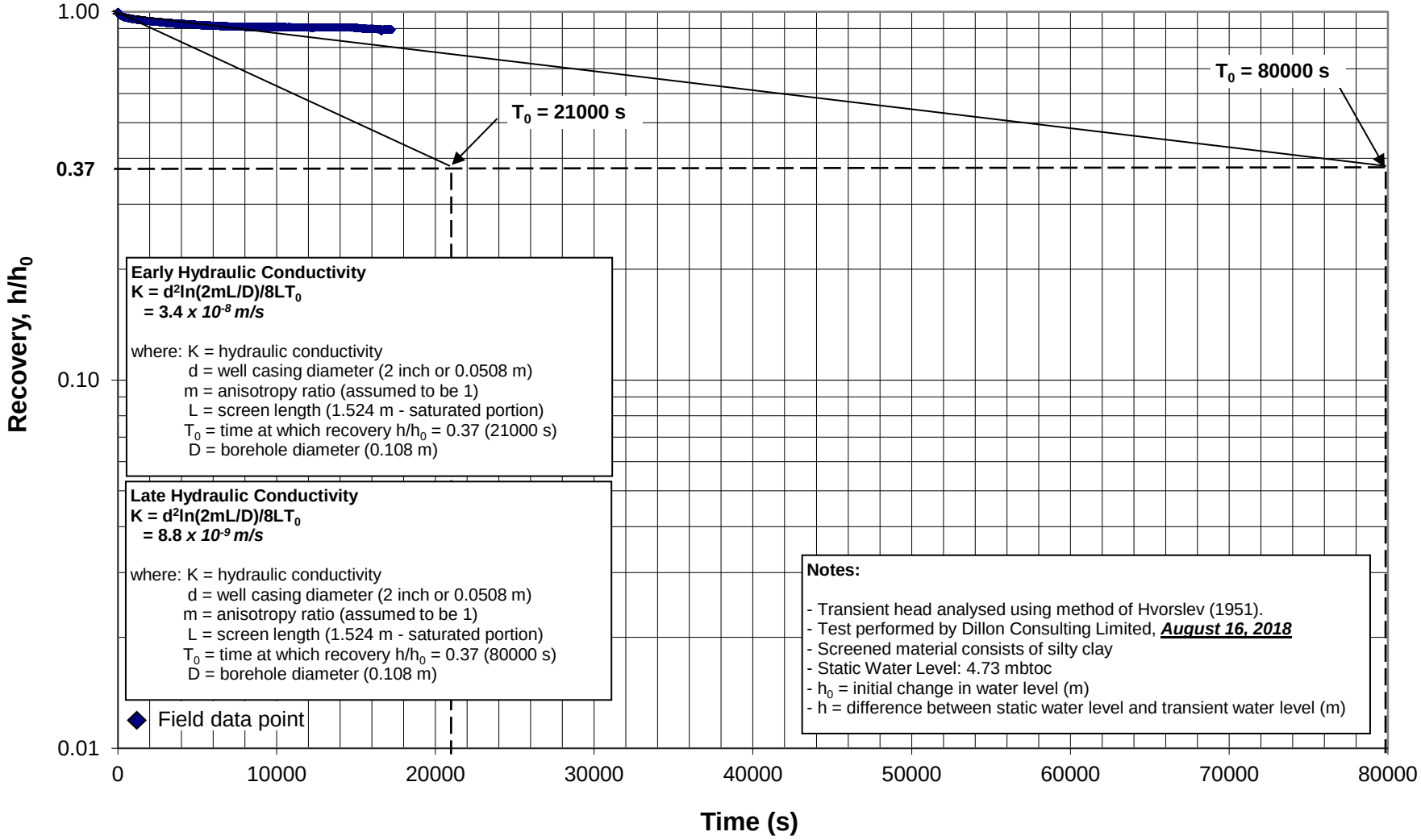
Appendix C

Rising Head (Slug) Tests

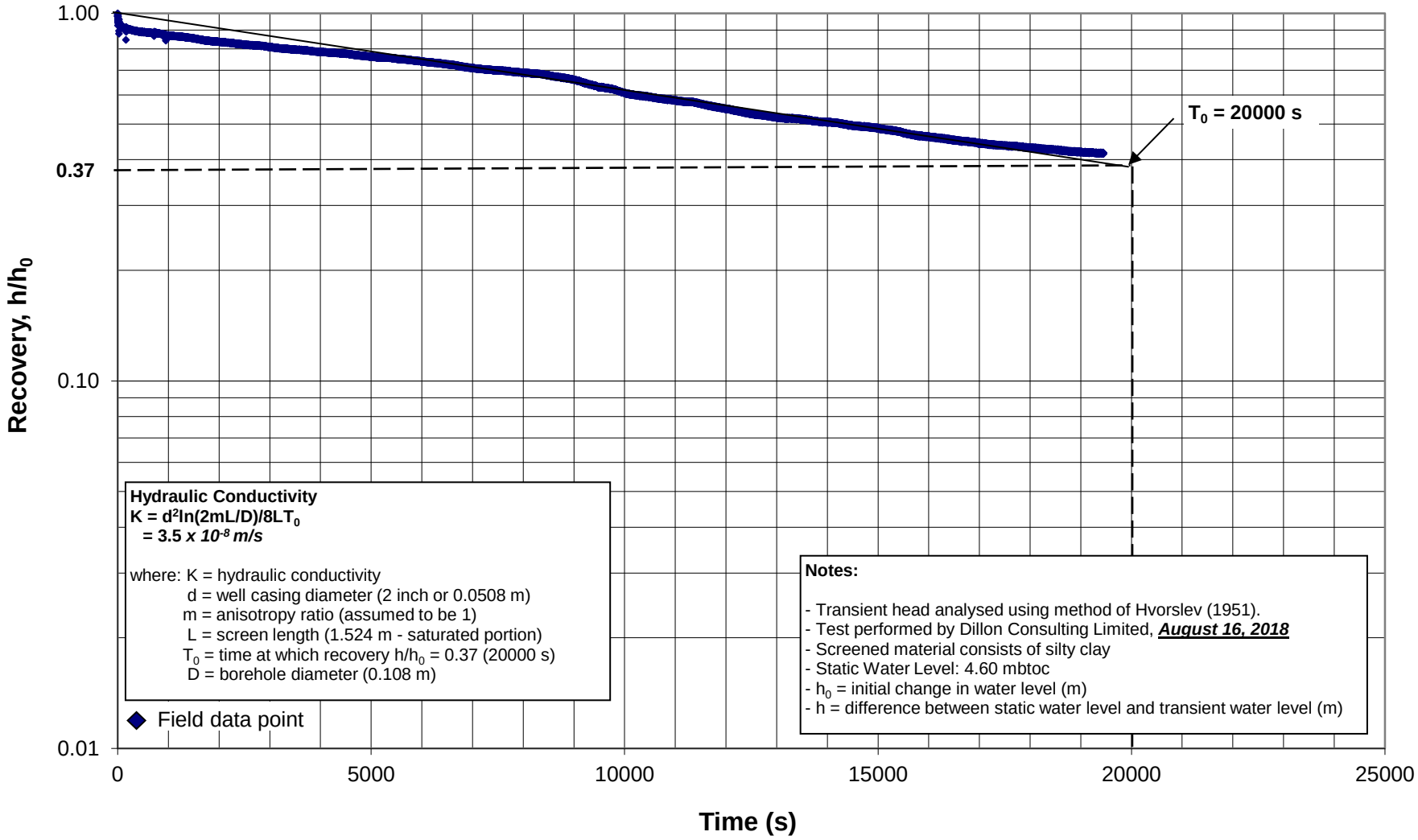
Rising Head (Slug) Test in Monitoring Well 18-8



Rising Head (Slug) Test in Monitoring Well 18-13



Rising Head (Slug) Test in Monitoring Well 18-5



Appendix D

Photographs

Appendix D – Site Photographs
Soil and Groundwater Assessment
Port Weller Search and Rescue Station

Photo 1: View looking northwest from the east edge of the site.

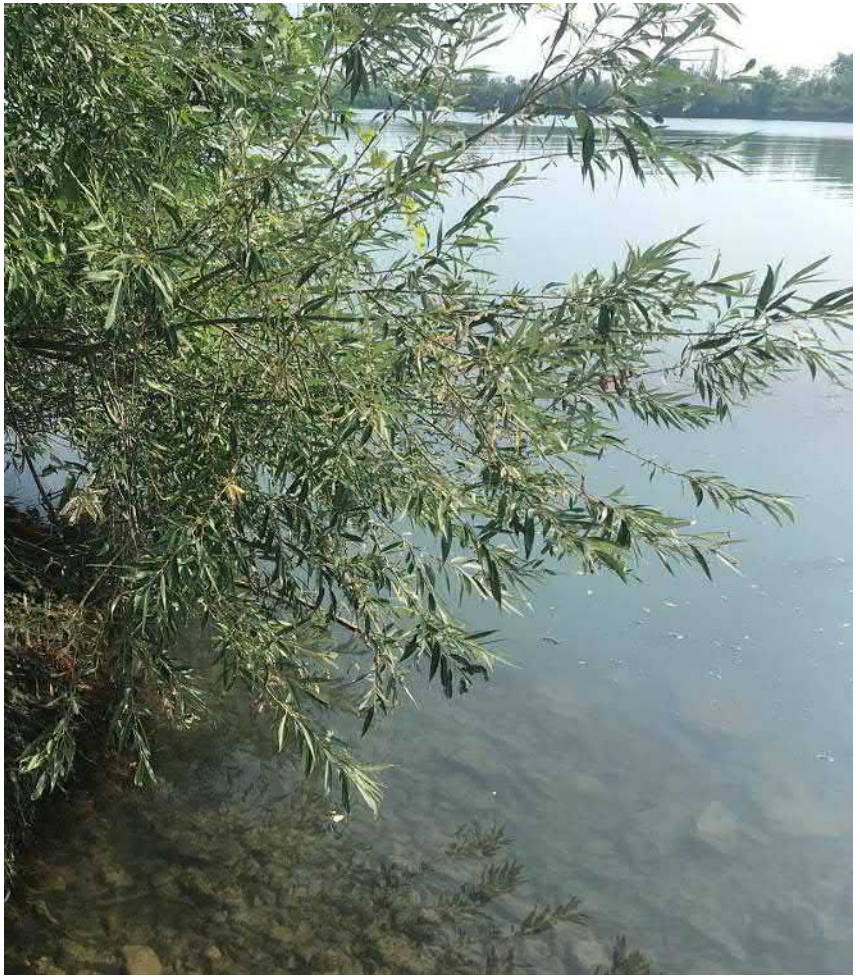


Photo 2: View looking northeast across the Welland Canal from the east edge of the site.

Photo 3: Historical photo looking south at the lighthouse and lightkeeper's residence. The structures were constructed c. 1931. The lighthouse was demolished in 1970. The lightkeeper's dwelling still remains on-site. (Source: http://lighthousefriends.com/light.asp?ID=1070)

Photo 4: Historical photo looking southwest at the lightkeeper's residence. The lightkeeper's residence still remains on-site. (Source: http://lighthousefriends.com/portweller_dwelling_1931_lac.jpg)

Photo 5: View looking west at the lightkeeper's residence. Shallow soil sample GS2, collected near the drip line of the building exceeded the federal criteria for lead.

Photo 6: View of soil samples collected from borehole 18-7.

Photo 7: View looking west from the Welland Canal towards the Port Weller Search and Rescue Station (taken in July, 2017) (source: https://www.flickr.com/photos/21953562@N07/35892621973).

Photo 8: Historical photo (taken in 1989) looking north along the west side of the 1953 residence building. A fuel oil AST is visible adjacent to the building. Fuel storage and handling activities at the site are identified as APEC 2.
(source: https://www.pc.gc.ca/apps/dfhd/page_fhbro_eng.aspx?id=3354&i=47535).

Appendix E

Utilities Locates

Primary Locate Sheet

Line Location Request

20183221120-1576405

Phone: 905-984-5197 Fax: 905-984-5367 Toll-Free: 877-558-5569

Priority 1

Locating For:	Revised Excavation Date:	Excavation Date:	Status:
Bell Canada, Enbridge Gas, Alectra Utilities (Horizon - SCH2),	14-Aug-18	14-Aug-18	LOCATE COMPLETED

Requested by:	Company:	Phone	Fax:	Requestor Type:
Jamie Sikorski	Dillon Consulting Limited	5194381288		CONTRACTOR

Appt. Date:	Received Date:	Type of Work:
8/14/2018 9:00:00AM	11-Aug-18	BORE HOLES

Locate Address:	Excavator Address:
4 WELLAND CANAL PKWY, ST. CATHARINES	1400-130 Dufferin AVE , London

Caller's Remarks:

CORLOT=U If further details needed please contact. Area is not pre-marked. Canadian Coast Guard PPTY // SITE MEET W/ JAMIE LEE 613-899-4569//NEED THIS DONE BY TUESDAY, AUG 14TH AS THIS PROCESS HAS ALREADY BEEN DELAYED //NEED AM APPT IF POSSDPRA:2 MARK AND EMAIL // UPDATED TYP PPTY AS WELL AS SITE MEET PRIORITY//20163016764| Lookup: LK_TICKET_STATUS_ID:41LK_LSP:21905 646-L2M

Gas	Bell	CATV	Hydro	Water	Sewer	Street Lighting	Fibre
M-1	M-1		M-2				

LOCATED AREA: EXCAVATOR SHALL NOT WORK OUTSIDE THE LOCATED AREA WITHOUT OBTAINING ANOTHER LOCATE

DPT Remarks:

☐ Third Party Notification

PRIVATE UTILITIES NOT MARKED BY P.V.S.

Records Referenced:

☐ Utility Map

☑ Multiviewer Datapak # 144

Atlas Plates: STC38,39

Field Notes: B280P123

Other:

Diameter of Main:

Excavator shall notify and receive a clearance from Regional Contacts Prior to excavation for the following:

Gas: ☐ End Thrust ☐ Vital Main ☐ Valve

Telephone: ☐ High Priority Cables ☐ Central Office Vicinity

Material Types

Gas: ☐ Cast Iron ☐ Steel ☐ Plastic

Telephone: ☐ Cable ☐ Conduit ☐ Telephone Fibre

CATV: ☐ TV Fibre

Hydro: ☑ Primary ☐ Direct Buried ☐ Secondary ☐ Duct ☐ Street Lighting

Water ☐ Locate is Approximate Due to Non-metallic Pipe

Method of Field Marking: ☑ Paint ☐ Stakes ☐ Flags ☐ Offset Stakes ☐ Chalk ☐ Steel

Caution: Locate is VOID after 30 days. See attached for Bell Canada. Alectra, Cogeco, Region of Halton, Toronto Hydro and Traffic/Rescue Locates valid for 60 days. Toronto Water valid for project. For locate requests, including remarks, contact Ontario One Call 1-800-400-2255.

Caution: The markings may disappear or be misplaced. Should sketch markings not coincide, a new locate must be obtained. This is based on information given at the time. Any changes to location or nature of work requires a new locate. The EXCAVATOR must not work outside the indicated Located Area without a further locate by the company. Privately owned facilities may be present in the Locate Area.

Documents given to be used with this locate:

☑ None

☐ NEB Excavation/Construction Booklet

☐ Gas Excavation Guidelines

☐ Hydro Electric Excavation Guidelines

☐ Bell Guidelines for Excavation

ID Number: 620 Cody P.

Date/Time: 14-Aug-2018 9:53 am

In/Out: 8:43 am 9:52 am

Accepted By: JAMIE-LEE

Print:

☑ Mark and Fax/Email ☑ Left on Site

A copy of this Primary Locate Report and the Auxiliary Locate Sheet(s) must be on site and in the hands of the machine operator during work operations. Should sketch and markings not coincide, a new locate must be obtained.

this form revised November 2015

Auxiliary Locate Sheet

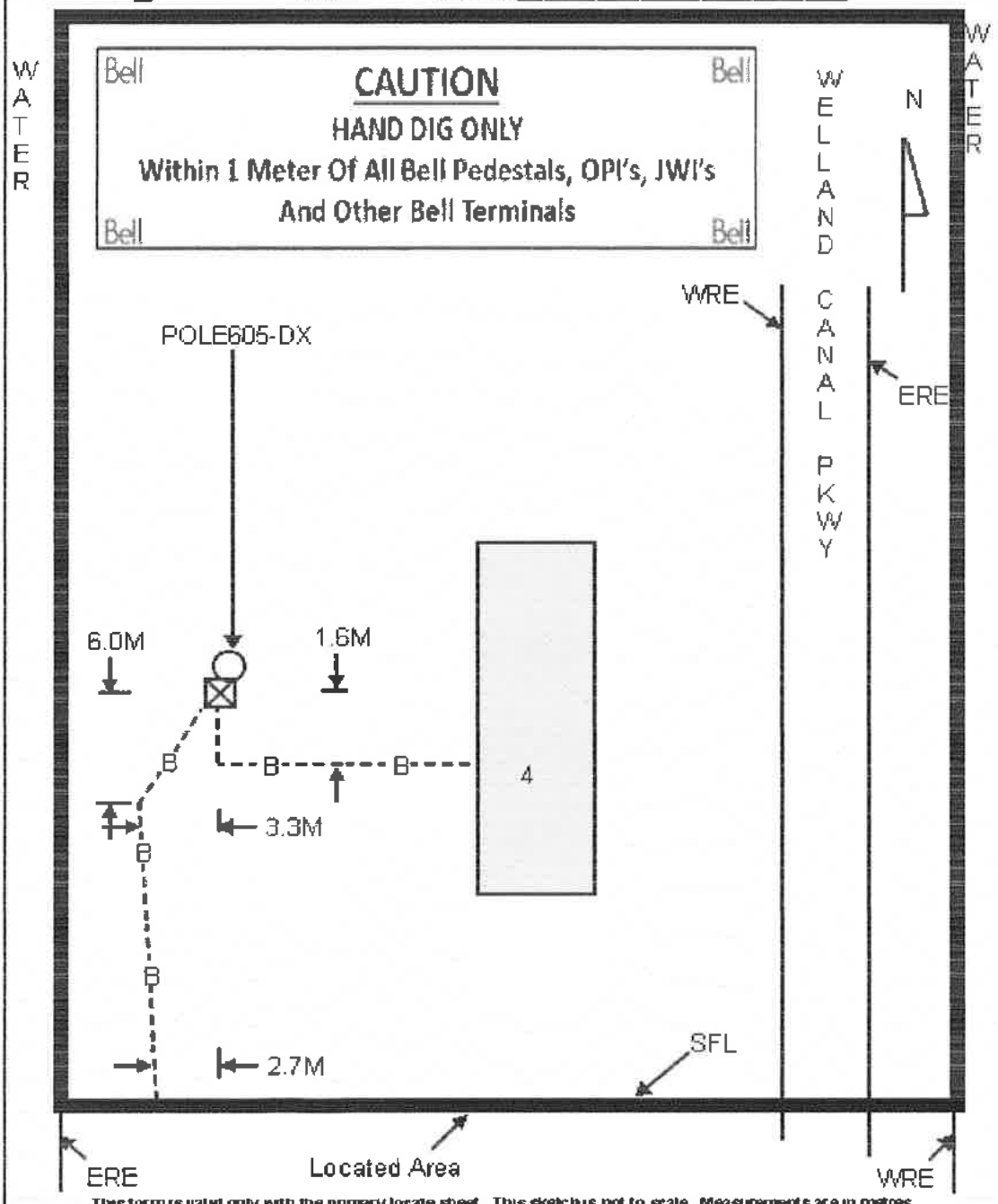
Phone: 905-984-5197 Toll Free: 877-558-5569 Fax: 905-984-5367

Utilities Located: Bell Canada, Bell Canada, Bell Canada,	Request #: 20183221120-1576405	Requested by: Dillon Consulting Limited
Number of Services Marked (Specify Building Numbers):		
LOCATED AREA: EXCAVATOR SHALL NOT WORK OUTSIDE THE LOCATED AREA WITHOUT OBTAINING ANOTHER LOCATE.		
From: 400.0M N OF POLE605-DX	To: SFL 4 WELLAND CANAL PKWY	
From: WRE OF WATER	To: ERE OF WATER	

LEGEND:

Building Line	BL
Fence Line	FL
Face of Curb	CL
Road Edge *Pavement edge of asphalt or road surface	RE
Driveway	DW
Manhole	M/H
Catch Basin	CB
Sidewalk	SW
Pole	
Limit of utility owned facilities	DM
Transformer	
Railway	
Gas Valve	
Pedestal	
Hydrant	
Buried Service Wire	-BSW-
Fiber Optic Cable	-FO-
Gas Main	-GM-
Gas Service	-GS-
Hydro Service	-HS-
Telephone Cable	-B-
Conduit	-C-
Hydro	-H-
Water	-W-
Cable TV	-TV-
Traffic Signal	-TS-
Street Light	-SL-
Sanitary Sewer	-SAN-
Storm Sewer	-ST-

HAND DIG WITHIN 1M (3.28ft) AS MEASURED HORIZONTALLY FROM THE FIELD MARKINGS
DEPTH VARIES AND MUST BE VERIFIED BY HAND DIGGING
☑ **LOCATED AREA HAS BEEN ALTERED AS PER:** SKETCH



This form is valid only with the primary locate sheet. This sketch is not to scale. Measurements are in metres.
Any privately owned services within the located area have not been marked – check with service/property owner

A Copy of this Auxiliary Locate Sheet and the Primary Locate Sheet must be on site and in the hands of the machine operator during work operations. Should sketch and markings not coincide, a new locate must be obtained.

This form revised November 2015

Auxiliary Locate Sheet

Phone: 905-984-5197 Toll Free: 877-558-5569 Fax: 905-984-5367

Utilities Located: Enbridge Gas,	Request #: 20183221120-1576405	Requested by: Dillon Consulting Limited

Number of Services Marked (Specify Building Numbers):

LOCATED AREA: EXCAVATOR SHALL NOT WORK OUTSIDE THE LOCATED AREA WITHOUT OBTAINING ANOTHER LOCATE.

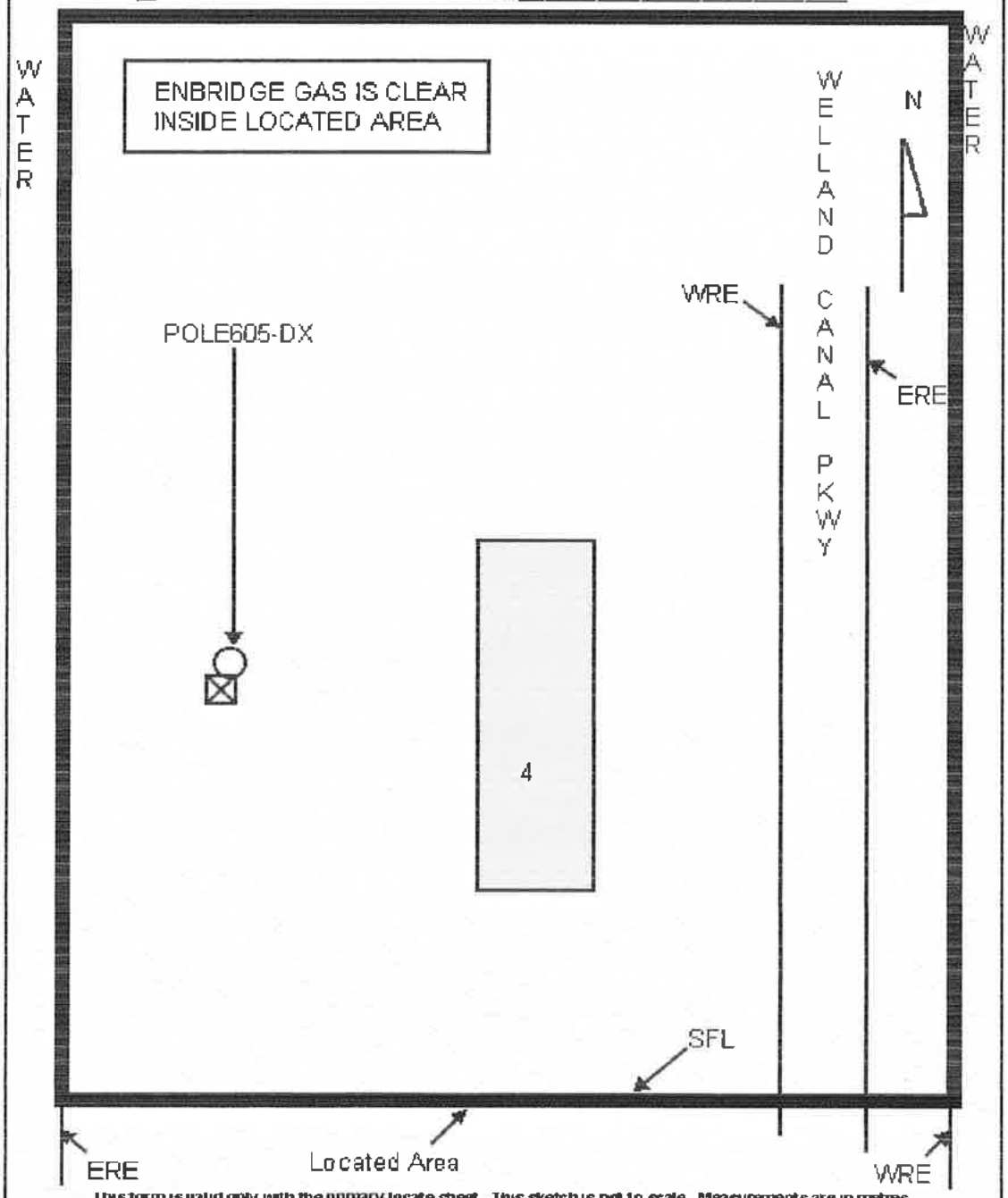
From 400.0M N OF POLE605-DX	To: SFL 4 WELLAND CANAL PKWY
From: WRE OF WATER	To: ERE OF WATER

LEGEND:

Building Line	BL
Fence Line	FL
Face of Curb	CL
Road Edge * *Pavement edge of asphalt or road surface*	RE
Driveway	DW
Manhole	MH
Catch Basin	CB
Sidewalk	SW
Pole	
Limit of utility owned facilities	
Transformer	
Railway	
Gas Valve	
Pedestal	
Hydrant	
Buried Service Wire	-BSW-
Fiber Optic Cable	-FO-
Gas Main	-GM-
Gas Service	-GS-
Hydro Service	-HS-
Telephone Cable	-B-
Conduit	-C-
Hydro	-H-
Water	-W-
Cable TV	-TV-
Traffic Signal	-TS-
Street Light	-SL-
Sanitary Sewer	-SAN-
Storm Sewer	-ST-

HAND DIG WITHIN 1M (3.28ft) AS MEASURED HORIZONTALLY FROM THE FIELD MARKINGS
DEPTH VARIES AND MUST BE VERIFIED BY HAND DIGGING

☑ **LOCATED AREA HAS BEEN ALTERED AS PER:** SKETCH



This form is valid only with the primary locate sheet. This sketch is not to scale. Measurements are in metres.
Any privately owned services within the located area have not been marked – check with service/property owner

A Copy of this Auxiliary Locate Sheet and the Primary Locate Sheet must be on site and in the hands of the machine operator during work operations. Should sketch and markings not coincide, a new locate must be obtained.

This form revised November 2015

Auxiliary Locate Sheet

Phone: 905-984-5197 Toll Free: 877-558-5569 Fax: 905-984-5367

Utilities Located: Alectra Utilities (Horizon - SCH2).	Request #: 20183221120-1576405	Requested by: Dillon Consulting Limited

Number of Services Marked (Specify Building Numbers):

LOCATED AREA: EXCAVATOR SHALL NOT WORK OUTSIDE THE LOCATED AREA WITHOUT OBTAINING ANOTHER LOCATE.

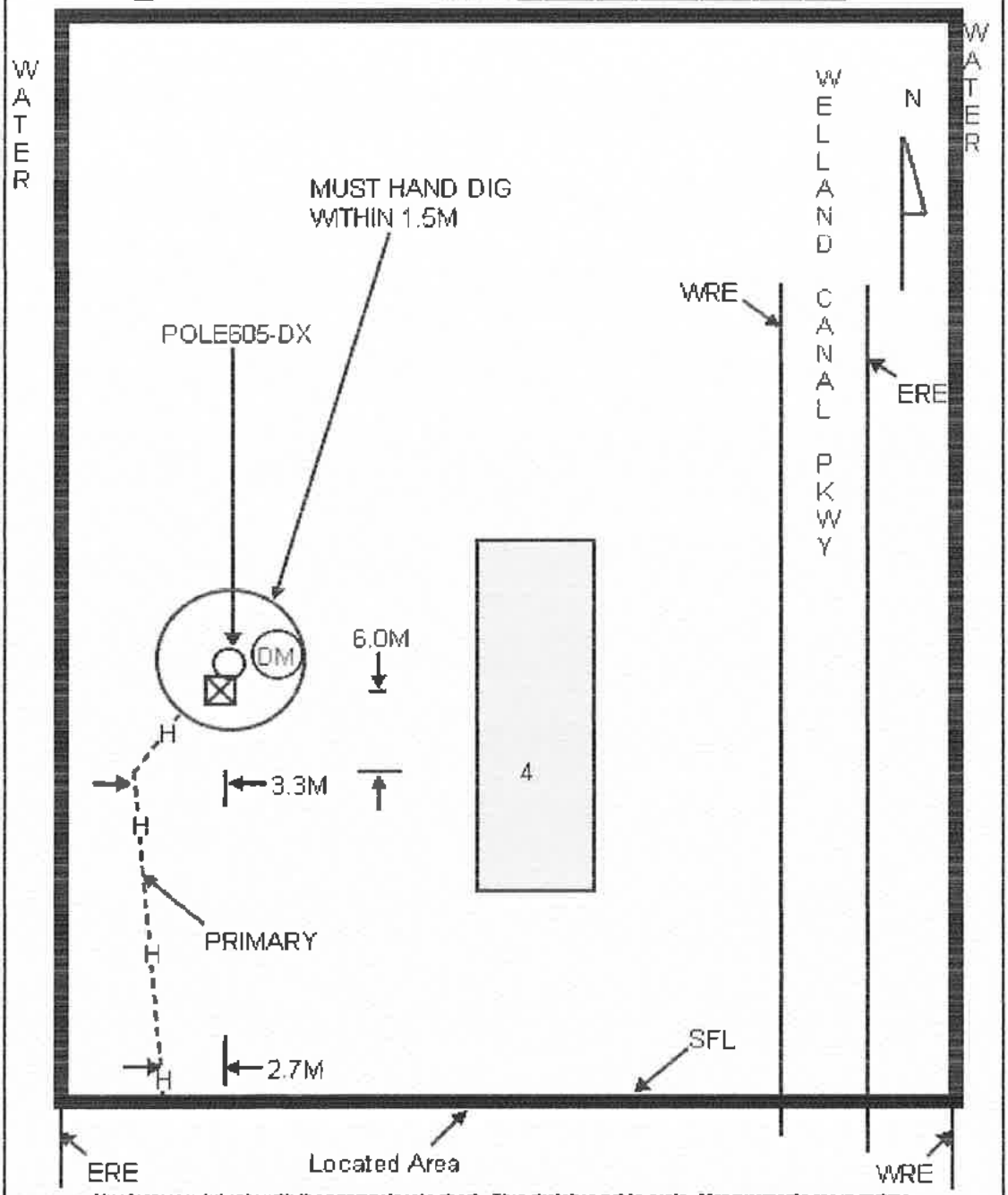
From: 400.0M N OF POLE605-DX	To: SFL 4 WELLAND CANAL PKWY
From: WRE OF WATER	To: ERE OF WATER

LEGEND:

Building Line	BL
Fence Line	FL
Face of Curb	CL
Road Edge *Pavement edge of asphalt or road surface	RE
Driveway	DW
Manhole	M/H
Catch Basin	CB
Sidewalk	SW
Pole	
Limit of utility owned facilities	DM
Transformer	
Railway	
Gas Valve	
Pedestal	
Hydrant	
Buried Service Wire	-BSW-
Fiber Optic Cable	-FO-
Gas Main	-GM-
Gas Service	-GS-
Hydro Service	-HS-
Telephone Cable	-B-
Conduit	-C-
Hydro	-H-
Water	-W-
Cable TV	-TV-
Traffic Signal	-TS-
Street Light	-SL-
Sanitary Sewer	-SAN-
Storm Sewer	-ST-

HAND DIG WITHIN 1M (3.28ft) AS MEASURED HORIZONTALLY FROM THE FIELD MARKINGS
DEPTH VARIES AND MUST BE VERIFIED BY HAND DIGGING

☑ **LOCATED AREA HAS BEEN ALTERED AS PER:** SKETCH



This form is valid only with the primary locate sheet. This sketch is not to scale. Measurements are in metres.
Any privately owned services within the located area have not been marked – check with service/property owner

A Copy of this Auxiliary Locate Sheet and the Primary Locate Sheet must be on site and in the hands of the machine operator during work operations. Should sketch and markings not coincide, a new locate must be obtained.

This form revised November 2015

FRONTIER
UTILITY LOCATING SERVICES INC.

Private Locate Standard Notes

701 Trinity Road, Unit 6, Jerseyville, ON L0R 1R0
www.frontierlocating.com
Phone: 905-548-7643
Fax: 905-548-7613

CLIENT

Company	DILLON CONSULTING LIMITED		
Applicant	RACHEL BRYAN		
Address	130 DUFFERIN AVE SUITE 1400		
City	LONDON, ON	Postal Code	N6A 5R2
Phone	519-438-1288	Cell	519-6728209
Email/Fax	RBRYAN@DILLON.COM		

PROJECT

Work Order	FWO- 554178
Purchase Order	MK0500-66-02
Project	SOIL SAMPLES
Site Address	PORT WELLER SEARCH & RESCUE
City	ST CATHERINES
Description	15 BOREHOLES

NOTES

PUBLIC LOCATES MUST BE OBTAINED PRIOR TO GROUND DISTURBANCE ACTIVITIES (ONTARIO ONE CALL: 1-800-400-2255).

NOTE: NON-CONDUCTIVE LINES INCLUDING, BUT NOT LIMITED TO, SOME SEWER AND WATER LINES MAY NOT BE DETECTABLE.

- ■ 1 Scanned within marked limits of locate for Power, Radio, and inductive signals (active & passive).
- ■ 2 Work areas are marked on site using:
  - ■ Paint ORANGE
  - ☐ Flags
  - ☐ Stakes
- ■ 3 Utility Records for site were not provided by client.
- ☐ 4 Access to site buildings was not provided. Unable to connect to services inside of the building (s) to locate utility lines.
- ☐ 5 Unable to access sewer lines due to the following:
  - ☐ Manhole/CB lid cannot be opened.
  - ☐ Obstruction on top of manhole/CB: _____
  - ☐ Utility Lines too deep to access: _____
  - ☐ Pipe obstruction: unable to sonde.
  - ☐ Manhole access is restricted due to confined space. No other means of access are available.
  - ☐ Service has blind connection to the main.
- ☐ 6 Equipment or materials restricted access to the area. Unable to complete scan/sweep at this location.
- ■ 7 Must drill within a 0 m radius of marked drill location(s).
- ■ 8 Hand dig within 3 meters of all termination poles, hydro transformers, splice pits/handwells, pedestals and communication/hydro chambers.
- ☐ 9 Do not excavate in this area due to:
  - ☐ Congested utilities
  - ☐ Unlocatable utilities
  - ☐ Other: _____
- ☐ 10 GPR scans were performed using:
  - ☐ RD1000
  - ☐ Conquest

  GPR signal could not penetrate due to: _____
- ☐ 11 Subsurface anomaly detected in this area by GPR: _____
- ■ 12 Utilities are not locatable. Material does not propagate signal as it may be plastic, asbestos transite, fibreglass or other non-conductive material.
- ☐ 13 Signal ends here. Line may continue, but signal does not propagate beyond this point. No other access to utility line is available. Line may be abandoned.
- ☐ 14 Other: _____

NOTICES

It is the applicant's ("the excavator's") responsibility to ensure that all utility owners are contacted prior to excavating. Hand dig to full depth of excavation within one (1) meter of markings. Depths of utility lines vary, and must be determined by hand digging.

Public Locates: Called? Y N (?) Available? Y (N) ? Reviewed? Y (N) ?

APPROVAL

Approval (Office only)
Approved by: (Print & sign) X
Date:

BILLING

Equipment		Personnel	Print	Initial	N/B
■ P&CLE:	5 hrs	Tech 1:	ADAM G.	5 hrs	☐
GPR:	hrs	Tech 2:		hrs	☐
Sonde:	hrs	Tech 3:		hrs	☐
Other:	hrs	Mob:		1.5 hrs	☐

SIGN

Locate Technician: (Print & sign) X ADAM GEDDES
Client: (Print & sign) X

Date: AUG 10/18
Expires: (30 days from date of Locate) SEPT 9/18

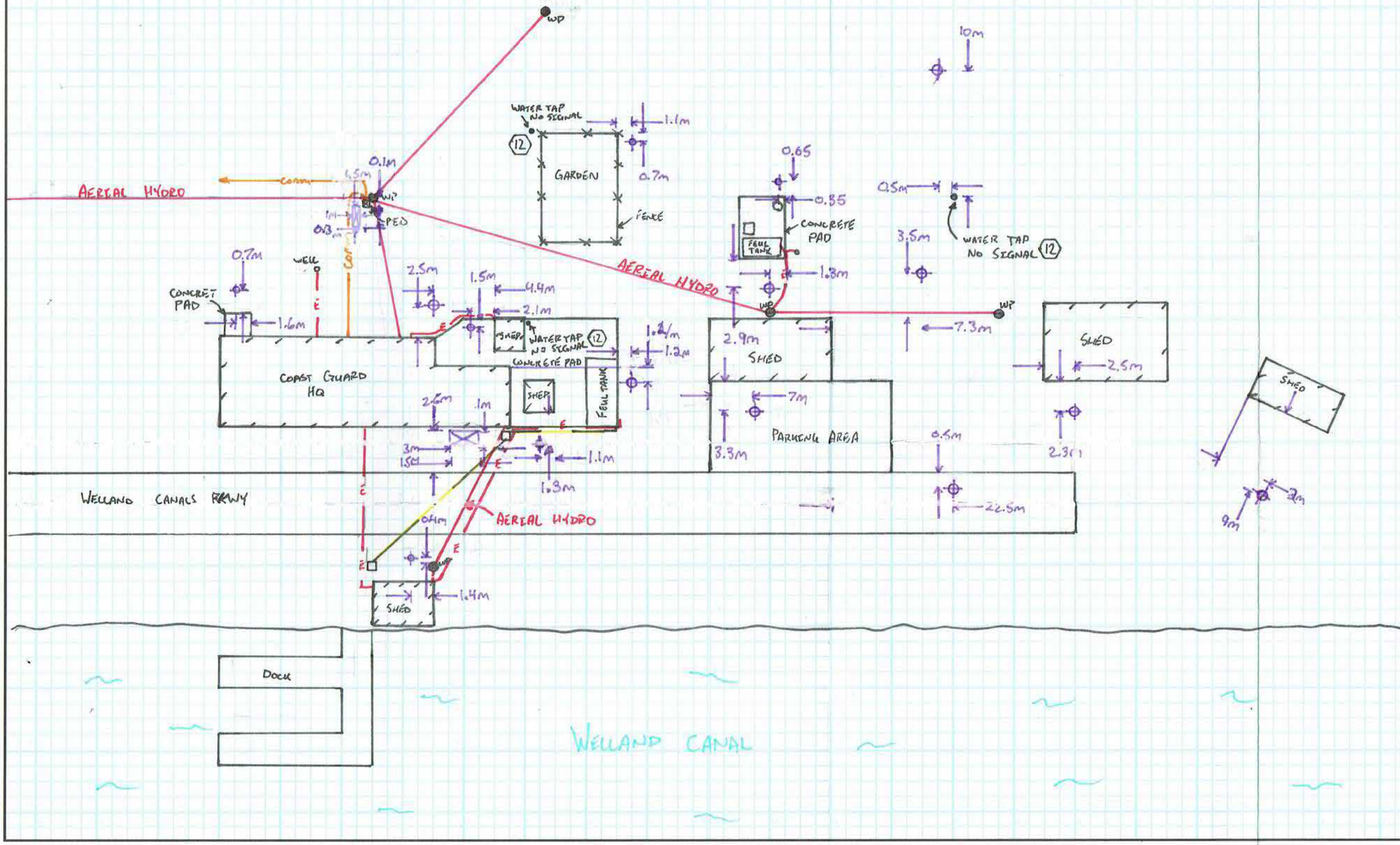
Total Hours: (Add Mob & Personnel Only) 6.5 hrs
Page: 1 of

White Copy - Frontier Yellow Copy - Client

= BOREHOLE LOCATION. DRILL IN MARKED LOCATIONS ONLY

= TEST PIT LOCATIONS. DIG IN MARKED LOCATIONS ONLY

NOTE: WATER LINES ARE PLASTIC WITH NO TRACER WIRE UNABLE TO LOCATE



FRONTIER
UTILITY LOCATING SERVICES INC.

701 Trinity Road South, Unit 6
Ancaster, ON L9G 3L1
P: 905-548-7643
F: 905-548-7613
E: projects@frontierlocating.com
W: www.frontierlocating.com

CLIENT

COMPANY	DILLON CONSULTING LTD
CONTACT	RACHEL BRYAN
ADDRESS	130 DUFFERIN AVE
CITY	LONDON, ON
POSTAL	N6A 5R2
PHONE	519-438-1288
CELL	519-672-8209
EMAIL/FAX	RBRYAN@DILLON.COM

PROJECT

W.O.	FWO- 554178
P.O.	MK0500-66-02
PROJECT	
ADDRESS	PORT WELLER SEARCH & RESCUE
CITY	ST CATHERINES
DESCRIPTION	15 BOREHOLES

APPROVAL (Office only)

Approved by: (Print & sign)	X
Date:	

SIGNATURES

Locate Technician (Print & sign)	X ADAM GEDDES
Client (Print & sign)	X
Date:	AUG 10/18
Expires: (30 days from date of Locate)	SEPT 9/18
PAGE	OF

Appendix F

Soil Disposal Information

293 Saunders Road, Barrie ON L4N 9A3
(705) 725 - 6262 1-800-465-2739 www.apexservices.ca
M.O.E. - Carrier #A840980

No. 20579

APEX Environmental Services Inc.

WORK ORDER / SHIPPING DOCUMENT

DATE 16/10/18 SHIPPED PREPAID ____ C.O.D. ____ (COLLECTED $ ____)

SHIPPER Coast Guard
GENERATOR 4 Welland Canals
St catherines, ON

PHONE # ____
WASTE MANIFEST # ____

INVOICE TO Terra Nova
1450 Headon Rd
Burlington, ON
POSTAL CODE L7M 4A3
PHONE # 416 829 5471
PO # 188083

TIME START (LOADING) 10:50 (AM/PM) TIME FINISHED (LOADING) ____ AM/PM

DG	PIN/UN/NA	PROPER SHIPPING NAME	CLASS	PG	M.O.E.	VOLUME	UNITS
—	—	Cutting soil (NON Reg NON haz)	—	—	—	900	kg
						3	Drums

SPECIAL INSTRUCTIONS ____

SHIPPER'S SIGNATURE [signature]

PLACARDS REQUIRED ____ CLASS ____ SHIPPER'S NAME ____

INTENDED RECEIVER CYANIDE DISTRUCT Systems / Apex
293 Saunders Rd
Barrie, ON L4N 9A3
705 725 6262

RECEIVER # A620200
PHONE # 705-725-6262

TIME IN (UNLOADING) ____ AM/PM FINISHED (UNLOADING) ____ AM/PM

DATE Oct 16 2018

RECEIVER'S SIGNATURE [signature]

RECEIVER'S NAME Denise Kruger

WEIGHT EMPTY ____ LBS/KG
LOADED ____ LBS/KG
TOTAL WEIGHT OF LOAD 900 LBS/(KG)

TRUCK 2343 TRAILER ____

DRIVER Phil Belcourt

THANK YOU FOR THIS OPPORTUNITY TO SERVE YOU

APEX ENVIRONMENTAL SERVICES INC. CERTIFICATE OF DESTRUCTION

This document certifies that all industrial waste materials received by Apex Environmental Services Inc. under Regulation 347 and Regulation 558 from:

Customer: Coast Guard

Address: 4 Welland Canals St Catherine's, ON

Date of Pickup: October 16, 2018

Generator Information: N/A

Manifest: Work Order # 20579

Description of Waste Materials: Non-Hazardous Cutting Soil

have been completely destroyed as of dd/mm/yyyy 17/10/2018

Apex Environmental Services Inc. Representative: (print) Dennis Kruger

(sign)

Apex Environmental Services Inc
293 Saunders Rd
Barrie, Ontario, L4N 9A3
www.apexservices.ca
1-800-465-2739
M.O.E. Receiver Site # A620200 – Carrier # A840980

SOIL AND GROUNDWATER ASSESSMENT RECOMMENDATIONS

February 5, 2019

Public Works and Government Services Canada
Environmental Services
4900 Yonge Street
Toronto, Ontario
M2N 6A6

Attention: Mr. Aman Gill
Project Manager, Environmental Specialist

Soil and Groundwater Assessment Recommendations
Port Weller Search and Rescue Station, Port Weller, Ontario

Dear Mr. Gill:

Dillon Consulting Limited (Dillon) is pleased to provide the following recommendations, cost estimates, and volume estimates for your consideration, based on the Soil and Groundwater Assessment completed at the Port Weller Search and Rescue Station, dated February 4, 2019.

Construction-Related Recommendations

- The contaminated soil on site should not be reused on the site.
- Soil generated through excavation during the construction should be disposed of at a facility licensed to accept non-hazardous waste. A receiving site should be identified by the contractor. Tipping fees for contaminated soil at the Niagara Region West Lincoln or Humberstone Landfill Sites are listed at $30/tonne. Assuming an approximate density of dry clay soil of 2 tonnes/m^3, tipping fees are estimated to be approximately $60/$m^3$. The cost of excess soil disposal should be included in the contractor's cost estimate for the construction project.
- Clean backfill is required and should be tested for potential contaminants of concern including one or more of PHCs, VOCs, PAHs and/or metals and inorganics to assess if soil quality meets applicable federal guidelines. The associated laboratory cost per sample, submitted on a 1-day rush turn-around time may be up to $500/sample, depending on the parameters analyzed.
- Methods should be implemented to ensure that recontamination of the clean backfill does not occur (ex. installing a geotextile liner). Estimated cost of a geotextile fabric is $1.50/$m^2$.
- Methods should be implemented to ensure that contamination is not spread at the site.

DILLON CONSULTING

130 Dufferin Avenue
Suite 1400
London, Ontario
Canada
N6A 5R2
Mail: Box 426
London, Ontario
Canada
N6A 4W7
Telephone
519.438.6192
Fax
519. 672.8209

- Decontamination measures should be implemented when working with the contaminated media.
- The contractor should implement mitigation measures to prevent contamination of the site from lead-based paints and other potentially contaminating materials during demolition and construction activities.
- The new well to be drilled as part of the construction project must be installed in the bedrock aquifer and sealed through the overburden fill and soils.
- If construction dewatering is required, further characterization of the groundwater may be required depending on how the excess groundwater is managed.
    - The contractor will need to determine the volume of water they expect to generate during dewatering in order to determine whether the water can be managed on-site or whether it will need to be hauled off-site for disposal.
    - If volumes are minimal, groundwater pumped from excavations can be placed in holding tanks on-site and tested to ensure water quality is suitable for discharge to ground surface.
    - If, based on anticipated volumes or other considerations, the contractor decides that groundwater should be removed by vac truck for off-site disposal, the contractor will need to identify a receiver for the groundwater (e.g. licensed treatment facility, municipal sewer). Additional testing may be required by the receiver.
    - In Ontario, a provincial Permit to Take Water (PTTW) is required for construction dewatering over 50,000 L/day under Section 34 of the *Ontario Water Resources Act*. Since the site is federally-owned, a PTTW is not required; however, if water takings are anticipated to exceed 50,000 L/day, the construction manager may recommend that the contractor obtain a PTTW to be consistent with provincial regulations.

Management-Related Recommendations

- Surface water quality in the Welland Canal and Lake Ontario should be tested to determine whether the water quality meets the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life for metals parameters including aluminium, cobalt, copper, iron, lead, and uranium, which were found to exceed the FIGQG in one or more shallow groundwater monitoring wells on the site. The FIGQG values that were exceeded are based on the migration of groundwater to surface water and exposure of freshwater aquatic life receptors. The estimated cost to complete surface water sampling and provide

recommendations based on the results is $6,901. A breakdown of the estimated fees, sub-consultants, travel costs, and expenses is attached as **Table 1**. The cost estimate is based on Dillon's standard rates. Actual costs may differ by up to 20%. The recommended scope of work would include the following:

  - one surface water sample collected from Lake Ontario at a location adjacent to the site
  - one surface water sample collected from the Welland Canal at a location adjacent to the site
  - one blind field duplicate sample

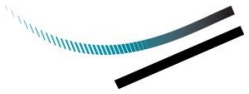
- Delineation of copper and lead exceedances in soil (AEC 1 and AEC 4) should be completed. Following delineation, a Risk Management/Remediation Options Evaluation should be completed. The estimated cost to delineate the soil exceedances and prepare a Risk Management/Remediation Options Analysis is $39,683. A breakdown of the estimated fees, sub-consultants, travel costs, and expenses is attached as **Table 2**. The cost estimate is based on Dillon's standard rates and estimates provided by sub-contractors. Actual costs may differ by up to 20%. Costs may also differ if the site configuration changes due to proposed construction activities at the site. The recommended scope of work would include the following:

  AEC 1:

  - Seven boreholes to 4.5 mbgs (approximate locations shown on **Figure 1**, attached) to provide horizontal and vertical delineation of copper impacted fill
  - Submit four soil samples collected at a depth of 1.5-2.0 mbgs for horizontal delineation from boreholes to the north, south, east and west of borehole 18-8.
  - Submit one sample from a depth of 2.0-2.5 mbgs from the same location as borehole 18-8 for vertical delineation
  - Collect and retain additional samples. Submit for analysis as needed to provide horizontal and vertical delineation of exceedances

  AEC 4:

  - Sixteen (16) boreholes to 1.5 mbgs (approximate locations shown on **Figure 1**, attached) to investigate and delineate lead impacts in soil from lead based paints used on the exterior of the lightkeeper's dwelling
  - Soil samples collected at 0.3 m depth intervals at each borehole



  - Submit seven samples from 0.0-0.3 mbgs from the boreholes closest to the building for analysis of lead and one sample from 0.3-0.6 mbgs from the borehole at previous sample location GS2
  - Collect and retain additional samples. Submit for analysis as needed to provide horizontal and vertical delineation of exceedances
- Lead based exterior paint on site structures should be inspected annually and maintained in good condition to prevent contamination of shallow soils at the site from flaking paint. The inspection should be conducted by Coast Guard staff as part of their regular facilities maintenance program and should not result in additional cost.

Estimate of Impacted Soil Volume

It is our understanding that DFO requires an estimate of the volume of impacted soil at the site for internal reporting. A soil volume estimate is provided below for AEC 1 for this purpose; however, as noted above, further delineation of the soil impacts is recommended.

AEC 1: Metal-Impacted Fill

A soil sample collected from borehole 18-8, north of the hoop house, contained copper at a concentration of 100 mg/kg, exceeding the federal guideline of 63 mg/kg. The sample was collected at a depth of 1.5-2.0 mbgs in the silty clay fill, which is inferred to be the source of the exceedance.

The copper impacted soil is estimated to be relatively localized, given that 16 other soil samples from across the site were submitted for copper analysis and all of them met the applicable guideline. Partial horizontal delineation of the copper exceedance in the fill has been established to the south by sample 18-2a (1.4-1.5 mbgs), to the west by sample 18-9 (1.5-2.0 mbgs), and to the north by sample 18-12 (1.0-1.5 mbgs). Horizontal delineation in soil has not been established to the east; however, for the purpose of this estimate, it is assumed that impacts extend to the east to borehole 18-7. Based on this assumption, the estimated horizontal extent of the copper-impacted fill is approximately 800 m^2. Vertical delineation of the copper impacts in soil has not been established at the location of the exceedance; however, deeper samples collected from boreholes 18-13 (3.9-4.4 mbgs) and 18-7 (4.6-5.5 mbgs) met the applicable criterion for copper. For the purpose of this estimate, it is assumed that the impacts extend from surface to a depth of 4 mbgs. Based on these assumptions, the estimated volume of copper-impacted soil is approximately 3,200 m^3.

AEC 1: Lead-Impacted Soil

Soil sample GS2, collected at a depth of 0.0-0.3 mbgs on the east side of the lightkeeper's dwelling contained lead at a concentration of 216 µg/g, exceeding the applicable CCME Tier 1 residential land use guideline of 140 µg/g. Although 16 other soil samples were analyzed for lead, none of them were collected from similar shallow depths near the lightkeeper's dwelling and therefore horizontal delineation of the lead-impacted area cannot be determined at this time. Similarly, although several deeper soil samples collected at the site show lead concentrations to be below the applicable CCME Tier 1 guidelines, there was not a deeper soil sample collected at the location of GS2, and therefore vertical delineation of the lead impacts has not been established. A soil volume estimate could not be provided for AEC 4 based on the available analytical data.

Closure

Thank you for inviting us to respond to this assignment. If you have any questions or require further information, please do not hesitate to contact us.

Sincerely,

DILLON CONSULTING LIMITED

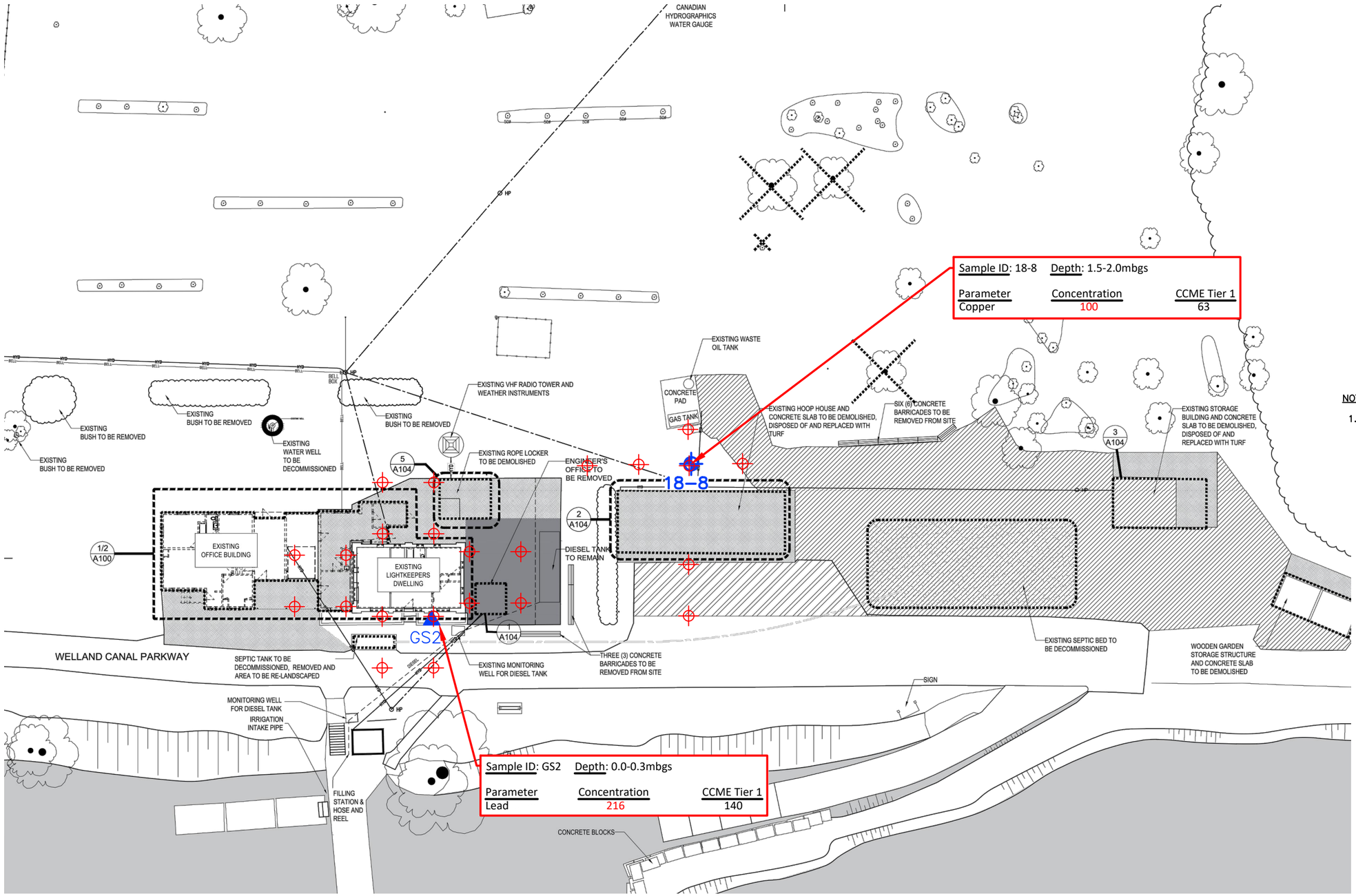
LICENSED PROFESSIONAL ENGINEER
R. E. BRYAN
100119016
2/5/2019
PROVINCE OF ONTARIO

Rachel Bryan, M.A.Sc., P.Eng.
Environmental Engineer

Our file: 18-8083

Attachments:

Figure 1 – Proposed Borehole Locations
Table 1 – Cost Estimate – Surface Water Assessment
Table 2 – Cost Estimate – Delineation of Soil Impacts at AEC 1 and AEC 4



NOTES:

1. PROPOSED BOREHOLE LOCATIONS ARE APPROXIMATE AND MAY NEED TO BE ALTERED BASED ON THE LOCATIONS OF SITE STRUCTURES AND UTILITIES.

Source: Drawing No. A010, Site Plan – Demolition, Port Weller, Ontario Department of Fisheries and Oceans Search & Rescue Station, St. Catharines. Partial Demolition, Addition and Restoration, Project No. R.079827.001

DILLON CONSULTING	PROJECT: SOIL AND GROUNDWATER ASSESSMENT, PORT WELLER SAR	PROJECT NO.: 18-8083
DATE: January 2019	TITLE: PROPOSED BOREHOLE LOCATIONS FOR FURTHER DELINEATION	FIGURE NO.: 1

FileName:c:\projectwise\working directory\projects 2018\10\rebl\dms35138\figure 1 - proposed drilling locations.dwg

Table 1: Cost Estimate for Surface Water Assessment
Port Weller Search and Rescue Station

Task	FEES			DISBURSEMENTS		
	Estimated Time (hours)	Rate ($)	Total	Quantity	Cost ($)	Total
Project Management and Coordination			$ 850.00			
Background Information Review			$ 520.00			
Health & Safety Plan			$ 235.00			
Field Work			$ 1,180.00			
Travel - mileage				300	0.50	151.33
Travel - per diem, meals				1	79.73	79.73
Multi-parameter water quality meter rental				1	300	$ 300.00
Report			$ 3,420.00			
Analytical - Water (Maxxam)						
CCME low level ICPMS Metals Scan				3	50.00	$ 150.00
Sample disposal fees				3	5.00	$ 15.00
Phase III ESA	**Subtotal fees**		**$6,205**	**Subtotal Disbursements**		**$ 696**
TRAVEL TOTAL				**$ 231**		
TOTAL (fees + disb (incl travel))				**$**		**6,901**

Note: This cost estimate is considered to have a +/- 20% margin of error

Table 2: Cost Estimate for Delineation of Soil Impacts
Port Weller Search and Rescue Station

Task	FEES			DISBURSEMENTS		
	Estimated Time (hours)	Rate ($)	Total	Quantity	Cost ($)	Total
Project Management and Coordination			$ 2,880.00			
Background Information Review			$ 1,040.00			
Health & Safety Plan, Subcontractor Documentation			$ 625.00			
Utility Locates and BH Layout			$ 1,980.00			
Travel - mileage				300	0.50	$ 151.33
Travel - meals				1	79.73	$ 79.73
Private Utility Locator				8	100	$ 800.00
Intrusive Investigation			$ 5,550.00			
Travel - mileage				400	0.50	$ 201.77
Travel - meals				3	79.73	$ 239.20
Travel - hotels				2	160	$ 320.00
Drilling subcontractor						$ 12,000.00
Surveying Equipment				1	200	$ 200.00
Soil cuttings disposal				2	300	$ 600.00
Photoionization Detector rental				1	300	$ 300.00
Reporting			$ 11,690.00			
Analytical - Soil (Maxxam)						
Lead				27	22.00	$ 594.00
Copper				11	22.00	$ 242.00
Sample disposal fees				38	5.00	$ 190.00
Phase III ESA	**Subtotal fees**		**$23,765**	**Subtotal Disbursements**		**$ 15,918**
TRAVEL TOTAL				**$ 992**		
TOTAL (fees + disb (incl travel))				**$**		**39,683**
10 % Contingency for the Project (not included in the above Total)						**$ 3,968**

Note: This cost estimate is considered to have a +/- 20% margin of error

SEARCH AND RESCUE STATION (SAR) REVITALIZATION, FINAL GEOTECHNICAL INVESTIGATION REPORT

Englobe
Soils Materials Environment

Public Works and Government Services Canada

Search and Rescue Station (SAR) Revitalization St. Catharine, Ontario

Final Geotechnical Investigation Report

Date: October 16, 2019
Ref. N°: 124-B-0017786-0-01-100-GE-R-0001-01

Public Works and Government Services Canada

Search and Rescue Station (SAR) Revitalization

St. Catharine, Ontario

Geotechnical Investigation Report | 124-B-0017786-0-01-100-GE-R-0001-01

Prepared by:

Qasim Cheema, P.Eng.
Geotechnical Engineer

Prepared by:

PP

Nan Du, M. Eng.
Engineer in Training

Reviewed by:

Houshang Akbari, P.Eng.
Senior Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER
H. AKBARI
Oct 16 2019
PROVINCE OF ONTARIO

1821 Albion Road, Suite 7, Toronto Ontario Canada M9W 5W8 – 416.213.1060 | F 416.213.1070 – info@englobecorp.com

TABLE OF CONTENTS

TABLE OF CONTENTS

Tables

Appendices

Property and Confidentiality

REVISION AND PUBLICATION REGISTER		
Revision N°	**Date**	**Modification And/Or Publication Details**
0A	2017-09-28	Draft Geotechnical Report
0B	2017-11-08	Draft Geotechnical Report- Deep Foundation added to Section 7 Frost Protection added Under Slab-on-Grade in Section 8.
00	2018-01-02	Submission of Final Geotechnical Report
01	2019-10-16	Submission of Final Geotechnical Report - update seismic classification

1 INTRODUCTION

Englobe Corp. has completed a geotechnical investigation for the proposed new building addition at Search and Rescue Station in St. Catharines, Ontario (hereinafter referred as to "Site"). It is understood that the new building will encroach partially into the footprint of the existing Office House basement. The building addition will be a single storey structure with no basement and approximately 2000sqf. The existing 1950's building (Office House) and its ancillary buildings (garage and shop) will be demolished. The existing 1930's heritage building (Gallery House) is to remain. The geotechnical investigation was completed at the request of Mr. Ray Kowalchuk, PWGSC Project Manager.

The purpose of this geotechnical investigation was to determine the general subsoil types and groundwater conditions within the project limits, and obtain samples for geotechnical laboratory examination and testing. Representative soil samples were also selected by Englobe and submitted for environmental analysis.

The results of the geotechnical investigation have been summarized and recommendations developed for the proposed new building addition including excavation and backfill considerations, temporary construction dewatering requirements, foundation considerations and disposal of excess materials.

2 PROJECT METHODOLOGY

The geotechnical investigation for this project consisted of the following components.

Subsequent to obtaining public and private service clearances at each borehole location, six (6) boreholes (BH1 to BH6) were advanced to approximately between 2.1 to 6.7 metres below ground surface (mbgs). The location of the boreholes is indicated on the attached Borehole Location Drawings provided in Appendix 1 and Borehole Logs is provided in Appendix 2. These boreholes were advanced on August 23, 2017. The boreholes were completed using a continuous flight of solid stem augers equipment supplied by Elite Drilling Limited operated under the continuous supervision of an Englobe field technician.

Subsoil samples were recovered at regular intervals of depth using a 50 mm O.D. split barrel sampler driven into the subsoil in accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). The recovered subsoil samples were visually examined in the field and then preserved and transported to the Englobe Toronto laboratory for geotechnical examination and testing. Additionally, select soil samples obtained from boreholes were also submitted to Eurofins Environmental Testing Canada (Eurofins) for environmental analysis. The boreholes were then promptly backfilled upon completion in conformance with Ontario Regulation 903 requirements (as amended). One (1) monitoring well was installed at borehole

location BH6 upon completion of the borehole. Water levels were measured when the drilling activities were completed on August 23, 2017, and prior to the well development on August 31, 2017. The results of water level monitoring are provided on the borehole logs in Appendix 2.

The borehole locations were surveyed by Englobe using SOKKIA GRX2 GNSS Receiver GPS connected to MAGNET Enterprise network referenced to MTM Zone 10 (NAD27-74 Adjustment). A summary of the Boreholes coordinates and elevations are summarized in Table 1.

Table 1 Summary of Boreholes Coordinates and Elevations

BOREHOLE NO.	COORDINATES, M		ELEVATION, MASL	BOREHOLE DEPTH, MBGS (ELEVATION, MASL)
	NORTHING	EASTING		
BH1	4,788,311.500	327,613.083	79.4	6.7 (72.7)
BH2	4,788,327.641	327,591.149	79.3	6.7 (72.6)
BH3	4,788,326.052	327,613.587	79.4	2.1 (77.3)
BH4	4,788,329.645	327,597.976	79.3	6.7 (72.6)
BH5	4,788,308.119	327,599.376	79.4	6.7 (72.7)
BH6	4,788,308.311	327,591.815	79.4	6.7 (72.7)

In the laboratory, each soil sample was examined as to its visual and textural characteristics by the project engineer. Moisture content determinations were carried out on all samples. In addition, Atterberg limits, unit weight, grain size analysis and hydrometer testing were completed on representative soil samples.

Representative subsoil samples were selected by Englobe and submitted to Eurofins for one or more of the following environmental analysis in accordance with Ontario Regulation 153/04 (as amended) and the Canadian Council of Ministers of the Environment (CCME) for metals and inorganic parameters, Volatile Organic compounds (VOCs), Petroleum Hydrocarbons (F1-F4), Polycyclic Aromatic Hydrocarbon (PAHs), and Ontario Regulation 558 for TCLP, metals/inorganics and Volatile Organic Compounds (VOCs). Two (2) select soil samples were also tested for Corrosivity. In addition, One (1) water sample from monitoring well BH6 was submitted to Eurofins and tested for Ontario Regulation 153/04 (as amended) and the CCME metals and inorganic parameters, VOCs, PHCs and PAHs. The complete chemical test results, including Eurofins Certificate of Analysis are provided in Appendix 4.

3 LABORATORY TESTING RESULTS

Soil samples recovered during this investigation were preserved and transported to the Englobe Toronto geotechnical laboratory for additional testing. Moisture content testing was completed on all recovered samples with the results plotted on the borehole logs attached in Appendix 2.

Three (3) representative samples were selected and tested to determine their gradation and hydrometer analysis, three (3) representative soil samples were tested for Atterberg limits, three (3) representative soil samples were tested for unit weight. The complete laboratory test results are included in Appendix 3.

The soil samples will be stored for a period of three (3) months from the date of sampling. After this time, they will be discarded unless arrangements are made for extended storage.

4 SUBSOIL CONDITIONS

The approximate borehole locations are indicated on the attached Borehole Location Drawing in Appendix 1, with the Borehole Logs provided in Appendix 2. The general subsoil conditions are outlined briefly below.

A concrete sidewalk was observed at BH 1 andBH3. The average concrete thicknesses was 130mm.

4.1 TOPSOIL

Topsoil was encountered at all borehole locations exceptBH1 and BH3. The average topsoil thickness was approximately 130 mm.

4.2 FILL (SILTY SAND/ SANDY SILT/ SILTY CLAYEY/ SAND AND GRAVEL/ SANDY SILTY CLAY/CLAYEY SILT)

A fill layer composed of Silty Sand/ Sandy Silt/ Silty Clayey/ Sand and Gravel/ Sandy Silty Clay/Clayey Silt, was encountered in all boreholes below the topsoil or pavement structure. The fill layer also consisted of cobbles and shale fragments.

This layer was very loose/soft to compact/very stiff in relative consistency/density, having SPT 'N' values ranging from 3 blows per 300 mm to 21 blows per 300 mm penetration. The in-situ moisture content of this material ranged from 6 to 23 (moist to wet) percent. The laboratory test results are presented in Appendix 3. A summary of testing for this layer is briefly outlined in Table 2.

Table 2 Summary of Gradation Results – Fill

BOREHOLE NO.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES, %				ATTERBERG LIMITS, %		
		GRAVEL	SAND	FINES		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
				SILT	CLAY			
BH4	SS2	20	17	23	40	39	20	19
BH6	SS3	32	21	18	29	38	19	19

4.3 SILT CLAY (CL)

The silty clay, some sand to sandy was encountered at all borehole locations below the Fill layer. All boreholes were terminated within this layer. This cohesions layers was soft to stiff in relative density, having SPT 'N' values ranging from 4 per 300 mm to 9 blows per 50 mm of penetration. The in-situ moisture content of this material ranged from about 12 to 27 (moist to very moist) percent. The laboratory test result are presented in Appendix 3.

A summary of testing for this layer is briefly outlined in Table 3 below.

Table 3 Summary of Gradation Results – Silty Clay

BOREHOLE NO.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES, %				ATTERBERG LIMITS, %		
		GRAVEL	SAND	FINES		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
				SILT	CLAY			
BH1	SS6	7	20	38	35	27	14	13

5 GROUNDWATER

One (1) monitoring well was installed in borehole BH6 to measure the stabilized groundwater level at the site. Stabilized groundwater was encountered at depths in the range of 1.7 mbgs, elevations of 77.7 m. It should be noted that the mean elevation of Lake Ontario around this area is approximately elevations of 74.8.

Table 4 summarises the measured ground water levels in each monitoring well.

Table 4 Summary of water level depth and elevation

BOREHOLE NO.	WELL ELEVATION, mASL	SCREEN DEPTH, mbgs	GROUNDWATER LEVEL, MBGS (ELEVATION, MASL)
BH6	79.4	4.4 – 5.9	1.7 (77.7)

6 ENVIRONMENTAL ANALYSIS RESULTS

6.1 Ontario Regulation 153/04 (O. Reg. 153/04) Standards

The soil analytical results were compared to the Full Depth Generic Site Condition Standards presented in the Ontario Ministry of the Environment and Climate Change's (MOECC's) "*Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*", Ontario Regulation 153/04 (O. Reg. 153/04), as amended. The following Site-specific information was used to determine the most applicable evaluation standards:

- The Site is located in the City of St. Catharines. Based on an interview with onsite staff, groundwater is used as a source of potable water at the Site;
- The Site located within 30 metres of a water body (Lake Ontario);
- The Site is currently utilized for residential purposes (rescue crews live at the Site) and industrial purposes (maintenance, fuelling and repair of ships and boats). Based on available information, Englobe understands that no future change in the land use of the property has been proposed at this time;
- Based on observations, the soil samples obtained is generally comprised of topsoil, sand and gravel, silt, and native silty clay.

Based on the aforementioned information, for the purpose of the environmental sampling, the soil analytical results have been compared to the Residential / Parkland / Institutional / Industrial / Commercial / Community property use standards within 30 meters of a water body in a potable groundwater condition for coarse textured soil as listed on Table 8 of the MOECC standards document (the MOECC Table 8 Standards).

The Toxicity Characteristic Leachate Procedure (TCLP) analytical results were evaluated against the Table 4 Leachate Quality Criteria referenced in Ontario Regulation 347 (as amended by O. Reg. 558/00).

Sixteen (16) soil samples with two (2) duplicate samples (sample ID: DUP-1, duplicate sample of BH-5-SS4 for analysis of PHCs, VOCs and PAHs, and DUP-2 duplicate sample of BH-5-SS-5 for analysis of Metals and Inorganics) were selected by Englobe and submitted to Eurofins for environmental analysis of Metal and Inorganic parameters, Volatile Organic compounds (VOCs), Petroleum Hydrocarbons Fractions F1-F4 (PHCs), Polycyclic Aromatic Hydrocarbon (PAHs) in accordance with Ontario Regulation 153/04 (as amended by Ontario Regulation 511/09). The bulk analysis results were then compared to the Residential / Parkland / Institutional / Industrial / Commercial / Community Property Use standards in a portable groundwater condition as listed on Table 8 of the MOECC Standards document (the MOECC Table 8 Standards – Soil). The Eurofins Certificate of Analysis is provided in Appendix 4. A summary of exceedances detected in the soil samples analyzed is provided in Table 5 below:

Table 5 Summary of Soil Sample Exceedances – O. Reg. 153/04

SAMPLE ID	ANALYTICAL PARAMETER	UNITS	CONCENTRATION	MOECC TABLE 8 STANDARDS – Residential / Parkland / Institutional / Commercial / Community / Industrial Property Use
BH2-SS1	Barium	ug/g	**1630**	220
	Copper	ug/g	**673**	92
	Lead	ug/g	**204**	120
	Mercury	ug/g	**1.8**	0.27
	Zinc	ug/g	**1070**	290
	PHCs F3	ug/g	**300**	240
	PHCs F4	ug/g	**150**	120
	SVOC - Fluoranthene	ug/g	**0.72**	0.69
BH2-SS5	EC	mS/cm	**1.42**	0.70
BH4-SS1	Mercury	ug/g	**0.3**	0.27
BH4-SS6	SAR	-	**0.78**	0.70
BH5-SS5	EC	mS/cm	**0.84**	0.70
BH6-SS5	EC	mS/cm	**1.28**	0.70

Notes:

XX – Test result exceeds the MOECC Table 8 O. Reg. 153/04 Standards.

For the remaining analytical results of the soil samples analyzed as shown in appendix 4, concentrations of the parameters analyzed either were not detected (within detection limits) or did not exceed the MOECC Table 8 Standards.

It should be noted that pH value of sample BH3-SS2 at depths between 0.8 mbg and 1.4 mbg is 10.7 which is not within the surface soil guidelines (between 5 to 9 for soil that is no more than 1.5 metres beneath the soil surface).

One (1) composite soil sample collected from boreholes BH1 and BH3, and one (1) composite soil sample collected from boreholes BH2 and BH4 to BH6 were submitted to the laboratory for Toxicity Characteristic Leaching Procedure (TCLP) analysis (VOCs and metals/inorganics). The results of the TCLP analysis (Appendix 4) indicated that the analyzed soil samples meet the Ontario Regulation 558/00 Schedule 4 criteria for the analyzed parameters; and therefore, are classified as non-hazardous for disposal purposes. The Eurofins Certificate of Analysis is provided in Appendix 4..

One (1) water sample (Sample ID: BH/MW-6) and a duplicate sample (DUP-1, duplicate sample of BH/MW-6 for all analyzed parameters) was collected from the monitoring well BH6 using low flow sampling techniques and submitted to Eurofins and tested for Ontario Regulation 153/04 (as amended) for metals and inorganic parameters, VOCs, PHCs and

PAHs. In addition, a trip blank sample provided by Eurofins was also submitted for VOCs analysis. The groundwater analysis results were then compared with the All Types of Property Use Standards in a portable groundwater condition as outlined in Table 8 of the MOECC standards document (the MOECC Table 8 Standards – Groundwater). A summary of exceedances detected in the groundwater sample analyzed is provided in Table 6 below:

Table 6 Summary of Groundwater Sample Exceedances – O. Reg. 153/04

SAMPLE ID	ANALYTICAL PARAMETER	UNITS	CONCENTRATION	MOECC TABLE 8 STANDARDS – Residential / Parkland / Institutional / Commercial / Community / Industrial Property Use
BH6	Cobalt	ug/L	7.7	3.8

Notes:

XX – Test result exceeds the MOECC Table 8 O. Reg. 153/04 Standards.

For the remaining analytical results of the groundwater sample analyzed as shown in appendix 4, concentrations of the parameters analyzed either were not detected (within detection limits) or did not exceed the MOECC Table 8 Groundwater Standards.

6.1.1 Canadian Council of Ministers of The Environment (CCME) Standards

As requested by the Client, the soil and groundwater results were also compared to the criteria as outlined in the Canadian Council of Ministers of the Environment (CCME) Standards. Since the Site is currently used for residential and industrial purposes, Englobe conservatively chooses the more stringent standards to compare the analytical results of soil and groundwater samples (Residential/Parkland Land Use) to. Tables 7 and 8 below summarizes the exceedances of soil and groundwater samples collected from the Site and submitted for analysis respectively.

Table 7 Summary of Soil Sample Exceedances – CCME Standards

SAMPLE ID	ANALYTICAL PARAMETER	UNITS	CONCENTRATION/VALUE	CCME SOIL QUALITY GUIDELINES FOR THE PROTECTION OF ENVIRONMENTAL AND HUMAN HEALTH RESIDENTIAL / PARKLAND LAND USE
BH2-SS1	Beryllium	ug/g	1,630	500
	Copper	ug/g	673	63
	Lead	ug/g	204	140
	Zinc	ug/g	1,070	200
	pH	-	10.7	6-8
BH6-SS2	pH	-	8.2	6-8

Notes:

XX – Test result exceeds the CCME Soil Quality Guidelines for Residential/Parkland Land Use.

Parameters of Benzene, Ethylbenzene and Toluene are non-detectable in the soil samples submitted for analysis but detection limits of the above noted parameters are higher the CCME Standards.

Table 8 Summary of Groundwater Sample Exceedances – CCME Standards

SAMPLE ID	ANALYTICAL PARAMETER	UNITS	CONCENTRATION /VALUE	CCME WATER QUALITY GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE, FRESH WATER, MARINE
BH/MW-6	Chloride	ug/L	**194,000**	120,000
	Uranium	ug/L	**19**	1

Notes:
XX – Test result exceeds the CCME Water Quality Guidelines – Fresh Water, Marine.
Parameters of Cadmium, Anthracene, Benz[a]anthracene, Fluoranthene, Pyrene and Chromium VI are non-detectable in the groundwater submitted for analysis, but detection limits of the above noted parameters are higher than the CCME Standards.

7 FOUNDATION CONSIDERATIONS

7.1 Shallow Foundation

It is understood that proposed new building will be a one storey building with no basement.

Based on the results of our geotechnical investigation, it should be possible to employ conventional spread and strip footings on native soil to support the building. The design bearing capacity of the soil and corresponding depth are summarized in Table 6.

Table 9 Bearing Pressure for Settlement (SLS), Factored Ultimate Soil Bearing Pressure (ULS) and Corresponding Founding Level

BEARING PRESSURE FOR SETTLEMENT (SLS), FACTORED ULTIMATE SOIL BEARING PRESSURE (ULS) AND CORRESPONDING FOUNDING LEVEL		
DEPTH, mbgs (Elev)	SLS	ULS
3.3 (76.7)	75	113

Both the total and differential settlement resulting from loads not exceeding the allowable loads recommended herein are estimated to be 25 mm and 10 mm respectively.

The base of the foundation excavations must be inspected by a qualified geotechnical engineer prior to concrete pour in order to confirm soil bearing capacity.

All footings must be founded below frost depth of 1.2 m.

7.2 Deep Foundation

Another alternative is to deep foundation system such as helical piles. The advantage of this method is to reduce the amount excavated soil and dewatering.

Helical piles are suitable for supporting the proposed building foundations. The shaft must be grouted within the soils to prevent buckling. The pile would need to be founded in stiff silty clay at 6.0 mbgs (Elev. 72.00). The recommended ULS and SLS bearing resistance for 300 mm

diameter helix, founded at approximate elevation of 72.00 would be 120 kPa and 90 kPa respectively.

The contractor must monitor and check the torque values when installing the piles to confirm the bearing capacity of the pile has been achieved. The minimum pile spacing (centre to centre) is three times the diameter of helix.

Helical piles have slender shafts that offer limited resistance to lateral loads for vertically installed shafts. In order to increase the lateral capacity of the helical piers foundations the size of the helical piles can be increased by installing the piles with a grouted column to increase the effective width of the shaft. Alternatively battered helical piles can be installed to resist lateral forces.

It is recommended that the helical piles be designed and installed by experienced specialist contractors. The allowable pile capacity proposed above should also be further confirmed based on the contractor selected system and specific helical pile configuration to be used.

All helical pile caps should have a permanent earth cover of 1.2 m for frost protection. The drilling and installation of the piles should be supervised by a Geotechnical Engineer.

8 FLOOR SLAB

Slab-on-grade construction may be employed for the new building. After properly grading the subgrade soils and proof rolling the exposed surface to identify any soft spots or areas exhibiting excessive deflections, (any soft or spongy areas should be sub-excavated and backfilled with approved compacted granular material placed in uniform lifts not exceeding 200 mm loose thickness and compacted to 100 percent SPMDD), a moisture barrier consisting of an approximately 200 mm layer of clear crushed stone should be placed over the prepared subgrade. The 19 mm clear stone should be placed by rafting it in over the prepared subgrade, taking care at all times to mitigate potential disturbance to the subgrade from foot and traffic compaction.

The upper fill material is mainly sand/gravel with clay and some silt, this material is not considered frost susceptible. As a precautionary measure we recommend installing 50 mm thick rigid insulations below the 200 mm clear stone and covering about 500 mm of exposed foundation walls.

9 EARTHQUAKE CONSIDERATIONS

The National Building Code (NBC) stipulates that a building should be designed to withstand a minimum live load due to earthquake.

The Canadian Foundation Engineering Manual (4th Edition) describes the equivalent static force procedures that can be used to calculate a design seismic base shear proportional to the weight of the building that is to be constructed.

A Multi-Channel Analysis of Surface Waves (MASW) investigation was conducted at the site by Geophysics GPR International Inc. (Geophysics GPR) on August 6th, 2019. As per the report dated October 4th, 2019 by Geophysics GPR, the average V_s value of 30 readings at the site is 368m/s +/-15% to 20%, with a maximum value of 399 m/s and a minimum value of 342 m/s. Based on the average V_s values determined by MASW method and table 4.1.8.4.A of the NBC, 2015 Edition. Based on the MASW results, seismic site response class “D” ($180 < V_s \leq 360$ m/s) can be used for earthquake load and effects in accordance with the NBC. A copy of Geophysics GPR report has been provided in Appendix 5.

10 EXCAVATION AND BACKFILL CONSIDERATIONS

The investigation results suggest that the excavation should be able to carry out to the depth required for the underground services and shallow foundation construction using conventional excavation equipment. Excavation side slopes in the upper 3.5 mbgs are expected to remain relatively stable when they are cut back and maintained at an angle not steeper than 45 degrees (1H:1V sloped from the base of the excavation). In the event that wet seams or zones were encountered during the excavation, some sloughing to flatter slopes (as flat as 3H:1V) should be expected during construction. If steeper excavation are contemplated in the upper subsoils, they must be properly shored to temporarily support the excavation sidewalls and any surcharge loads that may be applied during the construction period. Regardless, all excavations must be carried out in accordance with the Ontario Occupational Health and Safety Act (OHSA). The subsoils encountered at the site, as per OHSA criteria, would typically be considered:

Moist to Very Moist, Loose to Compact, Fill – Type 4

Moist to Very Moist, Soft to Stiff, Silty Clay – Type 3

Soil that will be generated as result of excavations can be used as backfill material as long as it is maintained within 2% of its optimum moisture content level as determined by a Standard Proctor Maximum Dry Density (SPMDD) test.

The on-site soil can be used as engineer fill material provided its moisture content remains within two (2) percentage points of the optimum value. In the event imported soil is required to

be used as engineered fill, it should be free of deleterious matter and its moisture content should be within 2 percentage points of optimum and the soil must comply with the residential/parkland property use criteria set in Table 8 of the ***"Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"; Ministry Of the Environmental, April 15, 2011.***

The fill should be placed in loose lifts that do not exceed 200 mm in thickness, compacted at least 100 percent Standard Proctor Maximum Dry Density (SPMDD). This will require full time inspection by a qualified geotechnical inspector.

The zone of engineered fill placement should extend at least 1.0 m beyond the exterior edges of any exterior footings and should extend outward at a 45 degree angle to eliminate any edge effects on the bearing capacity that will be realised.

11 DEWATERING AND DRAINAGE CONSIDERATIONS

Groundwater measurements conducted in one (1) well indicated the stabilized water level at the site is 1.7 mbgs, elevations in order of 77.7 m. Therefore, dewatering will be necessary in order to pour the foundations.

Dewatering facilities will be needed during construction. It is expected that mostly they will be comprised of pumps placed in strategically located sumps.

12 ASPHALT CONCRETE PAVEMENT

All deleterious material that is encountered must be stripped from the areas in which an asphalt concrete pavement is to be constructed on native soil or engineered fill.

The exposed subgrade should be subjected to proof rolling in the presence of a geotechnical engineer. It should also be compacted to a minimum 98% of its Standard Proctor Maximum Dry Density.

Where soft spots or areas of high deflection are identified during proof-rolling, these areas should be properly repaired by sub-excavating and replacing any obviously objectionable materials (topsoil for instance) with an additional 150 mm depth of Granular B Type I meeting OPSS 1010 requirements underlain by a reinforced geotextile (Terrafix 270R or equivalent).

Where required, the pavement subbase should be constructed using OPSS 1010 Granular B Type I material compacted to 100 percent of Standard Proctor Maximum Dry Density (SPMDD). The pavement base should be constructed using OPSS 1010 Granular A material compacted to 100 percent of SPMDD.

All HL 8 (15% RAP) binder course and HL 3 surface course hot-mix asphalt should be produced and placed meeting OPSS 1150 and 310 requirements. A joint transition treatment

will be necessary where old and new asphalt pavement layers abut. The recommended transition treatment consists of milling the old surface layer approximately 300 mm wide and 50 mm deep to provide better pavement tie-in to adjacent new asphalt pavement structure.

It is recommended that all construction joints at the ends of the pavement be cleaned with stiff bristle brooms and compressed air to remove all dust, dirt and other foreign matter. A tack coat should be applied to all construction joints prior to the placement of asphalt concrete to ensure an adequate bond between the old and new pavements.

The paved roadways and parking areas should be shaped and crowned to provide drainage. Provided this will be done, and all excavations for the sewer and buried utilities are backfilled and compacted to a dense state, the minimum pavement thicknesses detailed in the Table 10 are recommended.

Based on the SPT data the resilient modulus of the existing fill at a depth of 500 mm below ground surface is estimated to be 40 MPa.

Table 10 Minimum Pavement Thickness

DESCRIPTION	PARKING (LIGHT DUTY)	ROADS (HEAVY DUTY)	MATERIALS
Surface Course Asphalt	60 mm	40 mm	HL-3 Asphalt
Binder Course Asphalt	-	60 mm	HL-8 (20% RAP)Asphalt
Base Course	150 mm	150 mm	19 mm Crusher Run Limestone or Granular A
Sub-base Course	200 mm	300 mm	Granular B (Type I)

Sub-drains are recommended to be installed behind the curbs and gutters along the roadways and parking areas.

13 SOIL CORROSIVITY

Two (2) subsoil samples were submitted to Eurofins for corrosively analysis. The laboratory results are presented in Appendix 4. The samples were analysed for chloride, electrical conductivity, hydrogen sulphide, pH, Redox potential, resistivity and sulphate concentrations.

To determine the potential for corrosion, the laboratory results were compared to the American Water Works Association (AWWA) corrosivity rating system, as shown on Tables 11. AWWA rating is based on 10 points criteria. If a soil's Total Points is 10 or above, then protection is required as per C105/A21.5 (ANSI/AWWA, 1999) and A674-00 (ASTM 2000).

Table 11 Summary of Potential for Corrosion

PARAMETER	AWWA RATING SYSTEM		TEST RESULTS (ASSIGNED POINTS)	
	RESULT	ASSIGNED POINTS	BH3-SS2	BH6-SS2
Resistivity (ohm·cm)	< 700	10	1790 (1)	2860 (0)
	700 – 1,000	8		
	1,000 – 1,200	5		
	1,200 – 1,500	2		
	1,500 – 2,000	1		
	> 2,000	0		
PH	0 - 2	5	10.7 (0)	8.2 (0)
	2 - 4	3		
	4 - 6.5	0		
	6.5 - 7.5	0		
	7.5 - 8.5	0		
	> 8.5	3		
Redox Potential (mV)	> 100	0	285 (0)	341 (0)
	50 - 100	3.5		
	0 - 50	4		
	< 0	5		
Sulfides	Positive	3.5	1 (0)	<1 (0)
	Trace	2		
	Negative	0		
Moisture Content (%)	Poor drainage	2	Fair (1)	Fair (1)
	Fair drainage	1		
	Good drainage	0		
TOTAL POINTS			**2**	**1**

Corrosion protection is required if total points calculated based on (AWWA) corrosivity rating system equals or exceeds 10. The test result shows a total point value of two for BH3-SS2 (0.76 to 1.37 m depth) and one (1) for BH6-SS2 (0.76 to 1.37 m depth), which indicates that the subsoil have not significant corrosion potential. In addition, percentage of sulphate (SO4) in the soil samples testes are between 0.02% to 0.06%, and based on this analysis, there is not a significant potential for sulphate attack on concrete. Accordingly, normal Type (GU) Portland cement can be used in subsurface concrete.

14 CLOSING REMARKS

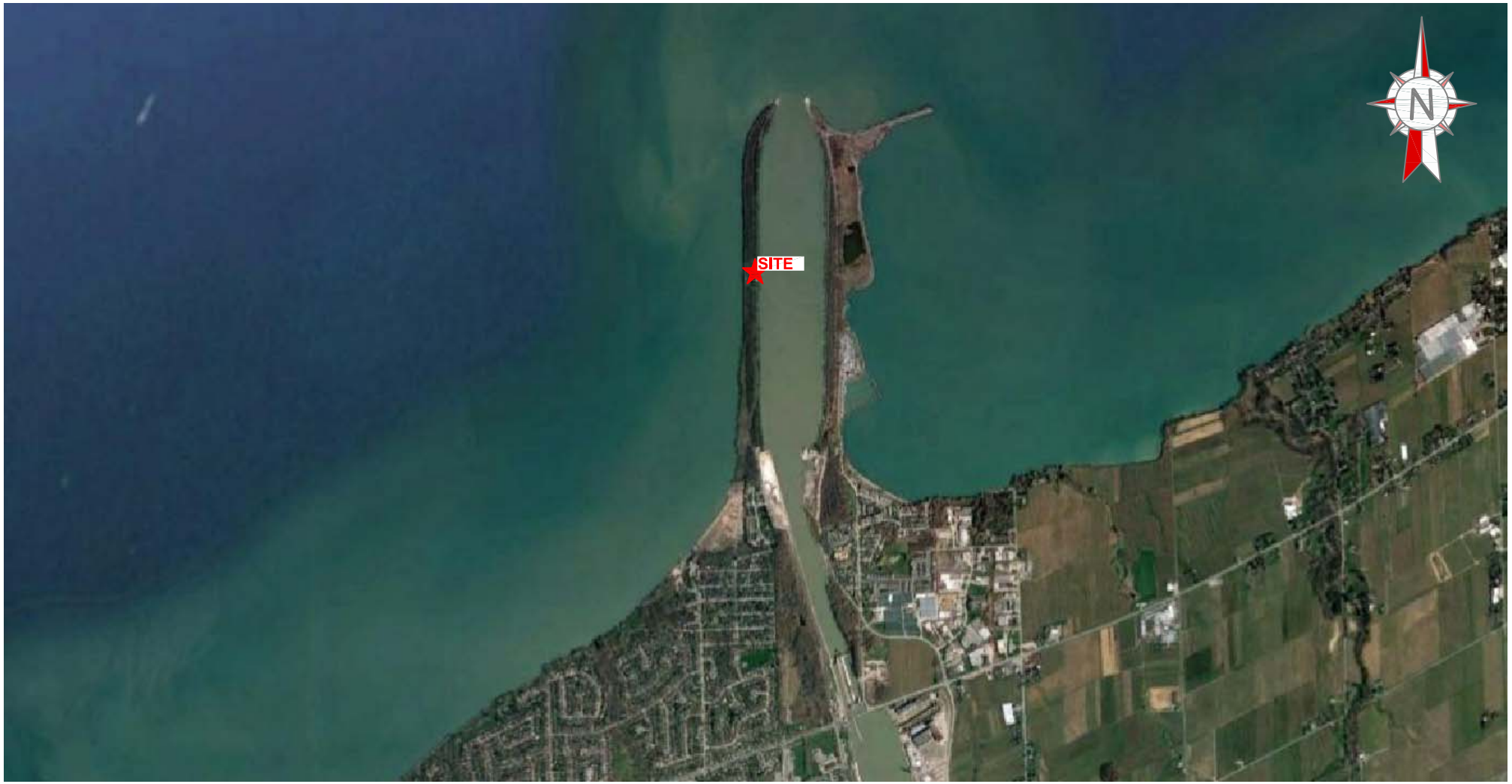
The comments provided in this report have been developed for the use of Public Works and Government Services Canada. It should be noted that on the borehole logs, the soil boundaries indicated are inferred from non-continuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design. Also, the subsoil and groundwater conditions have been determined at the borehole location only.

The recommended bearing capacity has been calculated by Englobe from the information obtained from the borehole data.

It is further noted that, depending on the time of year the fieldwork was completed, water levels should be expected to vary, perhaps significantly, from those observed at the time of this investigation.

Appendix 1 Borehole Location Plan

C:\USERS\KAMAMO\DESKTOP\MAI TEMP\QASEM DWGS\DRAWINGS\B-0017789-0-01_DWG.DWG



★ SITE LOCATION

NOTES :

1 - REFERENCES : Google Earth 2017.

2 - Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

PORT WELLER

SEARCH AND RESCUE(SAR) STATION REVITALIZATION

ST. CATHARINES, ON.

Title

SITE LOCATION PLAN

Englobe

1821, Albion Road, Unit 7
Toronto (Ontario) M9W 5W8
Telephone : 416.213.1060
Fax : 416.213.1070

Prepared	M. Kamala	Discipline	GEOTECHNICAL ENGINEERING	Project manager	H. Akbarl
Drawn	M. Kamala	Scale	N.T.S.	Sequence no.	01 of 02
Checked	Q.Cheema	Date	2017/09/15		

M. dept.	Project	Work pckg.	Sub-w.p.	Disc.	Type	Drawing no.	Rev.
124	B-0017786	0-01	100	PE	D	01	00

C:\USERS\KAMAMO\DESKTOP\MAI TEMP\QASEM DWGS\DRAWINGS\B-0017789-0-01_DWG.DWG

BOREHOLE LOCATION

NOTES :

1 - REFERENCES : Google Earth 2017.

2 - Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

PORT WELLER

SEARCH AND RESCUE (SAR) STATION REVITALIZATION

ST. CATHARINES, ON

Title

BOREHOLE LOCATION PLAN

Englobe

1821, Albion Road, Unit 7
Toronto (Ontario) M9W 5W8
Telephone : 416.213.1060
Fax : 416.213.1070

Prepared	M. Kamala	Discipline	GEOTECHNICAL ENGINEERING	Project manager	H. Akbari
Drawn	M. Kamala	Scale	N.T.S.	Sequence no.	02 of 02
Checked	Q.Cheema	Date	2017/09/15		

M. dept.	Project	Work pckg.	Sub-w.p.	Disc.	Type	Drawing no.	Rev.
124	B-0017786	0-01	001	PE	D	02	00

Appendix 2 Borehole Logs

LOG OF No. BH1

Englobe

Project No. B-0017786-0-01 DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR) Sheet No. 1 of 1

Location: St. Catharines, ON

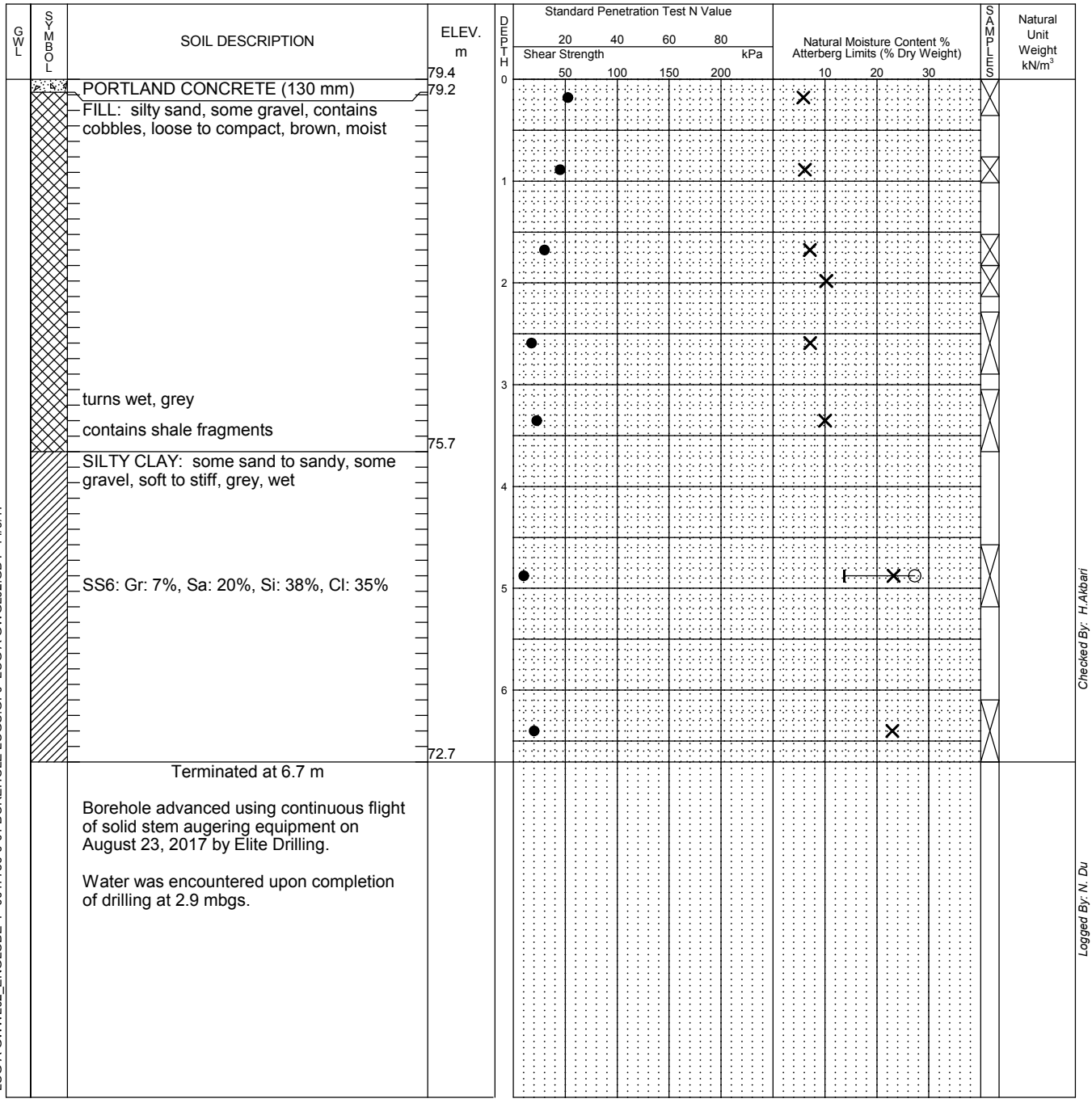
N 4,788,311.500 E 327,613.083

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test



Checked By: H.Akbari

Logged By: N. Du

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.9	

LOG OF No. BH2

Englobe

Project No. B-0017786-0-01 DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR) Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,327.641 E 327,591.149

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		TOPSOIL (130 mm)	79.3 / 79.2	0
		FILL: silty sand, some gravel, loose, brown, moist		
		FILL: silty clay, some gravel, firm, brown, moist	78.5	1
		FILL: silty sand, some gravel, loose, brown to grey, moist	77.8	
		turns grey	77.5	2
		FILL: silty clay, some gravel, stiff, grey, moist	77.1	
		FILL: silty sand, some gravel, loose to compact, grey, moist to wet		3
		turns wet		
		SILTY CLAY: some gravel, trace sand, stiff, grey, wet	75.9	4
				5
				6
			72.6	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
SAMPLES
Natural Unit Weight kN/m³: 17.0

Terminated at 6.7 m

Borehole advanced using continuous flight of solid stem augering equipment on August 23, 2017 by Elite Drilling.

Water was encountered upon completion of drilling at 2.7 mbgs.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.7	

Checked By: H.Akbari

Logged By: N. Du

LOG A GWWL02_ENGLOBE P-0017786-0-01 BOREHOLE LOGS.GPJ LOG A GWGL02.GDT 14/9/17

LOG OF No. BH3

Englobe

Project No. B-0017786-0-01 DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR) Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,326.052 E 327,613.587

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Weight kN/m³
		PORTLAND CONCRETE (130 mm)	79.4	0	20 40 60 80 / 50 100 150 200	10 20 30		
		FILL: silty sand, some gravel, very loose to compact, brown, moist	79.3					
				1				
				2				
			77.3					
		Terminated at 2.1 m						
		Borehole advanced using continuous flight of solid stem augering equipment on August 23, 2017 by Elite Drilling.						
		No Water was encountered upon completion of drilling.						

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	

Checked By: H.Akbari

Logged By: N. Du

LOG A GWWL02_ENGLOBE P-0017786-0-01 BOREHOLE LOGS.GPJ LOG A GWGL02.GDT 14/9/17

LOG OF No. BH4

Englobe

Project No. B-0017786-0-01 DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR) Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,329.645 E 327,597.976

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			79.3	0
		TOPSOIL (130 mm)	79.2	
		FILL: sand and gravel, loose, grey to red, moist	78.5	
		FILL: sandy silty clay with gravel, firm to stiff, brown, moist SS2: Gr: 20%, Sa: 17%, Si: 23%, Cl: 40%		1
		turns grey	77.5	
		FILL: sandy silt, some gravel, loose, red to grey, moist	77.1	2
		FILL: sandy silty clay, some gravel, stiff, grey, moist	76.3	
		FILL: sandy silt, some gravel, firm, red to grey, moist turns wet	75.6	3
		SILTY CLAY: some gravel, trace sand, firm, grey, wet		4
				5
				6
			72.6	
		Terminated at 6.7 m		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES

Natural Unit Weight kN/m³

Borehole advanced using continuous flight of solid stem augering equipment on August 23, 2017 by Elite Drilling.

Water was encountered upon completion of drilling at 3.0 mbgs.

Checked By: H.Akbari

Logged By: N. Du

LOG A GWWL02_ENGLOBE P-0017786-0-01 BOREHOLE LOGS.GPJ LOG A GWGL02.GDT 14/9/17

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.0	

LOG OF No. BH5

Englobe

Project No. B-0017786-0-01 DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR) Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,308.119 E 327,599.376

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			79.4	0
		TOPSOIL (130 mm)	79.3	
		FILL: silty clay, some gravel, firm to stiff, brown to red, moist		
		turns grey		1
				2
			76.7	
		SILTY CLAY: some gravel, trace sand, firm to stiff, grey to red, wet		3
		turns wet		4
		contains sand pockets, wet		5
				6
			72.7	
		Terminated at 6.7 m		
		Borehole advanced using continuous flight of solid stem augering equipment on August 23, 2017 by Elite Drilling.		
		Water was encountered upon completion of drilling at 3.7 mbgs.		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES

Natural Unit Weight kN/m³: 16.7

Checked By: H.Akbari

Logged By: N. Du

LOG A GWWL02_ENGLOBE P-0017786-0-01 BOREHOLE LOGS.GPJ LOG A GWGL02.GDT 14/9/17

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.7	

LOG OF No. BH6

Englobe

Project No. B-0017786-0-01 DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR) Sheet No. 1 of 1

Location: St. Catharines, ON

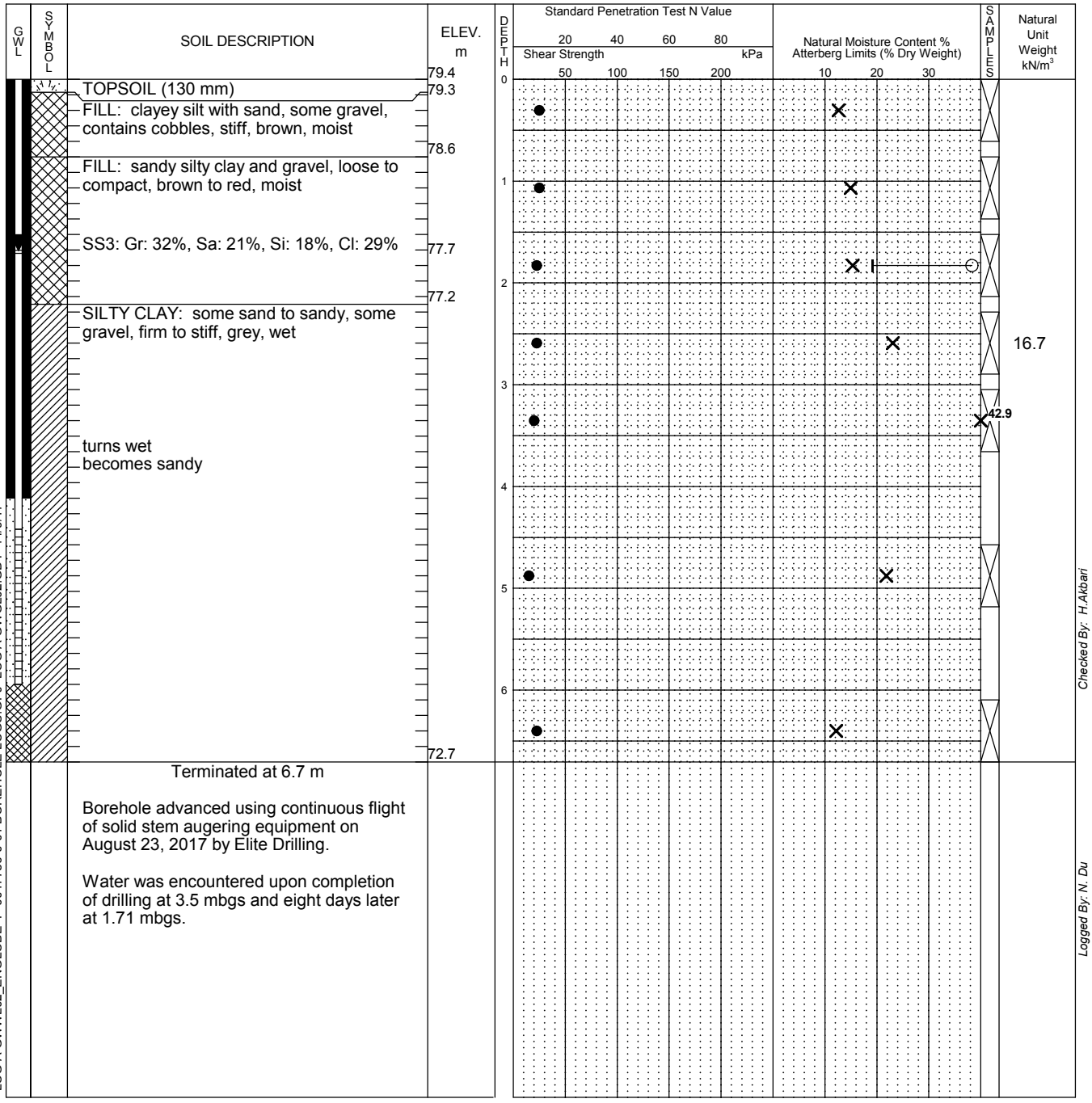
N 4,788,308.311 E 327,591.815

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test



Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.5	
August 31, 2017	1.7	

Appendix 3 Geotechnical Laboratory Results

Englobe
1821 Albion Road, Unit 7 Toronto (Ontario) M9W 5W8
T 416.213.1060 | F 416.213.1070
toronto@englobecorp.com | www.englobecorp.com

GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT
MTO LS-602, 702, AND 703/704

PROJECT: B-0017786 CLIENT/JOB NAME: Public Works & Government Services CONTRACT NUMBER: -

ROS ID: 70231 PROJECT/LOCATION: Geotechnical Investigation Services/ Port Weller

SAMPLING LOCATION:	BH1 SS6
SAMPLING DEPTH, m	4.5 - 5.2
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	ND, Englobe
SAMPLE DESCRIPTION:	Sandy Silty Clay, trace Gravel
SAMPLING DATE:	2017-08-24
SAMPLE RECEIVED DATE:	2017-08-24
GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	6.7
% SAND (75 µm to 4.75 mm):	19.9
% Silt (5 µm to 75 µm):	38.7
% Clay (<5 µm):	34.7
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	58.1
37.5	100.0	0.026	52.4
26.5	100.0	0.017	47.3
19.0	100.0	0.010	42.1
13.2	98.1	0.007	38.3
9.5	96.5	0.005	34.7
4.75	93.3	0.003	30.0
2.36	89.1	0.001	22.2
1.18	86.2	ATTERBERG LIMITS, %	
0.60	82.4		
0.30	79.3	Plastic Limit	13.7
0.15	77.2	Liquid Limit	27.3
0.075	73.4	Plastic Index	13.6

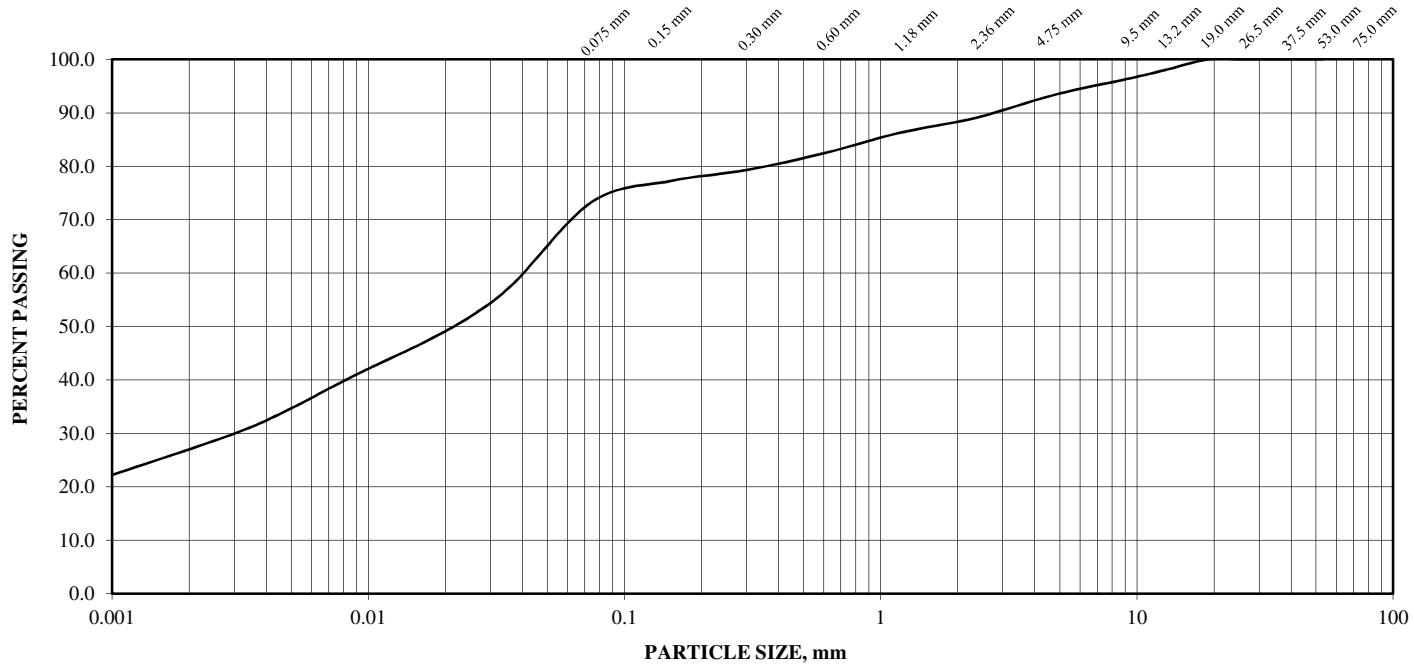
PARTICLE SIZE DISTRIBUTION, MTO LS-702

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



Englobe
1821 Albion Road, Unit 7 Toronto (Ontario) M9W 5W8
T 416.213.1060 | F 416.213.1070
toronto@englobecorp.com | www.englobecorp.com

GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT
MTO LS-602, 702, AND 703/704

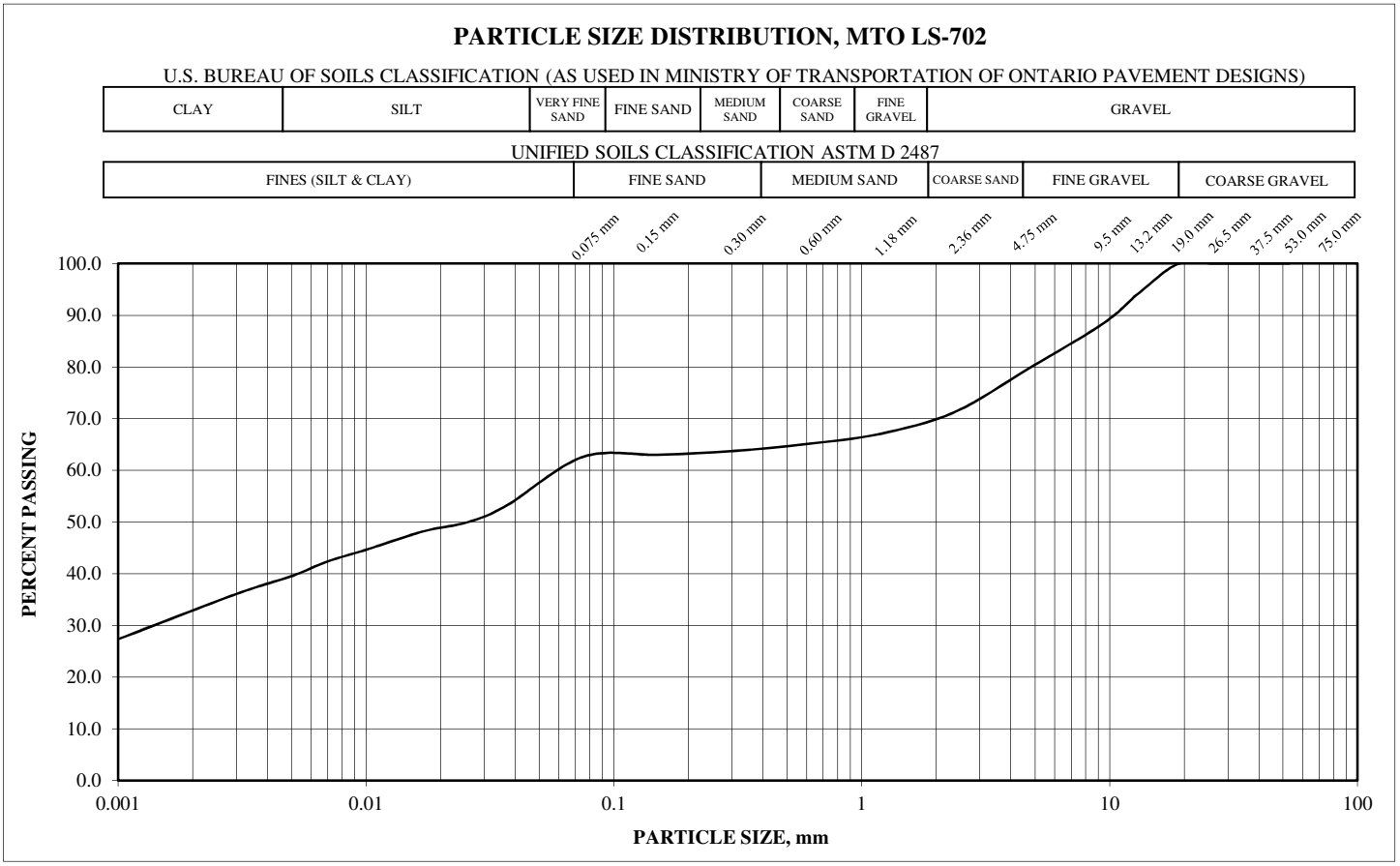
PROJECT: B-0017786 CLIENT/JOB NAME: Public Works & Government Services CONTRACT NUMBER: -

ROS ID: 70231 PROJECT/LOCATION: Geotechnical Investigation Services/ Port Weller

SAMPLING LOCATION:	BH4 SS2
SAMPLING DEPTH, m	0.76 - 1.37
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	ND, Englobe
SAMPLE DESCRIPTION:	Sandy Silty Clay with Gravel
SAMPLING DATE:	2017-08-24
SAMPLE RECEIVED DATE:	2017-08-24
GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	20.2
% SAND (75 µm to 4.75 mm):	17.2
% Silt (5 µm to 75 µm):	23.1
% Clay (<5 µm):	39.5
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	53.2
37.5	100.0	0.026	50.0
26.5	100.0	0.017	48.2
19.0	100.0	0.010	44.6
13.2	94.4	0.007	42.4
9.5	88.5	0.005	39.5
4.75	79.8	0.003	36.1
2.36	71.2	0.001	27.3
1.18	67.0	ATTERBERG LIMITS, %	
0.60	65.1		
0.30	63.7	Plastic Limit	19.8
0.15	63.0	Liquid Limit	39.3
0.075	62.6	Plastic Index	19.5

PARTICLE SIZE DISTRIBUTION, MTO LS-702



Englobe
1821 Albion Road, Unit 7 Toronto (Ontario) M9W 5W8
T 416.213.1060 | F 416.213.1070
toronto@englobecorp.com | www.englobecorp.com

GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT
MTO LS-602, 702, AND 703/704

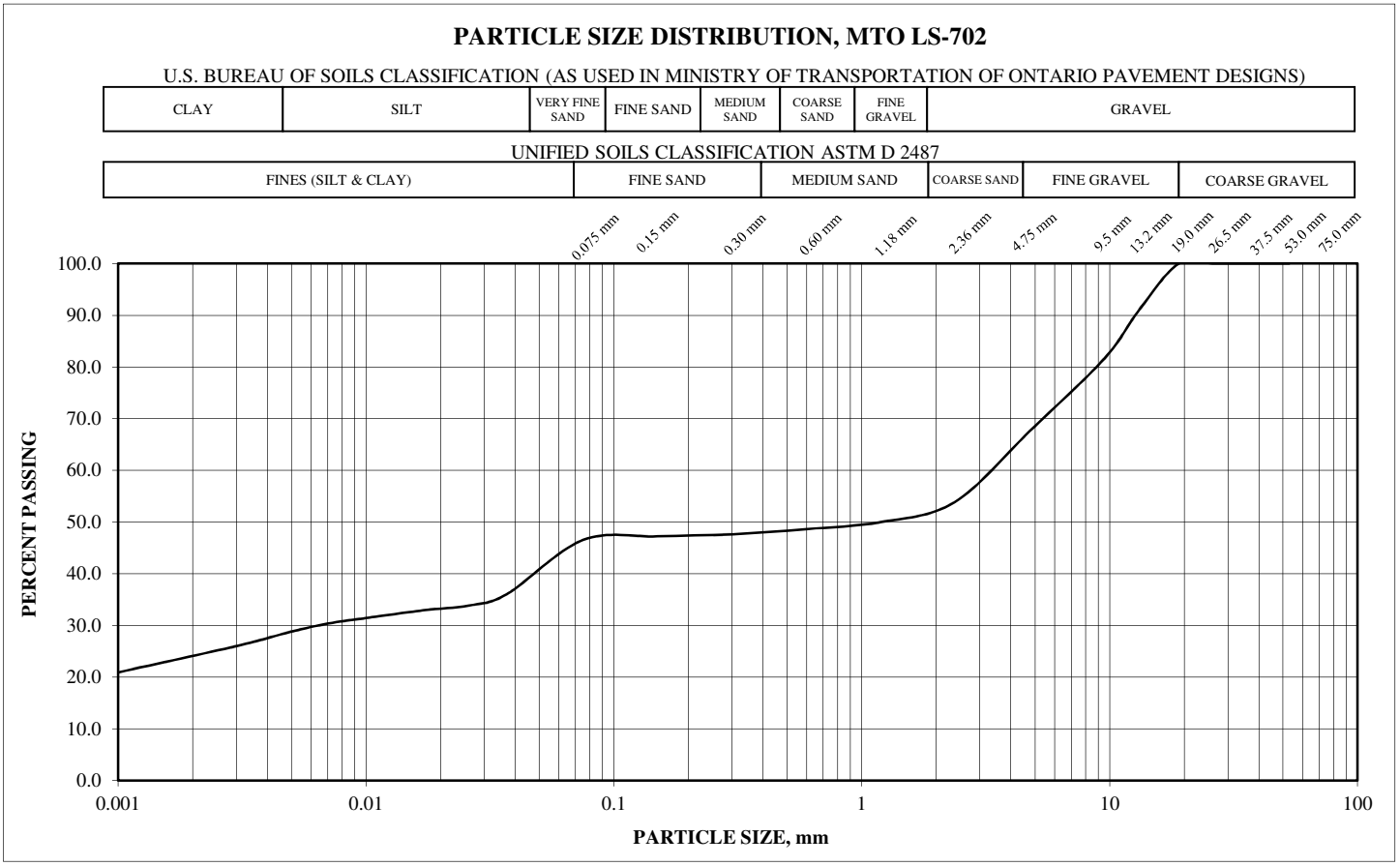
PROJECT: B-0017786 CLIENT/JOB NAME: Public Works & Government Services CONTRACT NUMBER: -

ROS ID: 70231 PROJECT/LOCATION: Geotechnical Investigation Services/ Port Weller

SAMPLING LOCATION:	BH6 SS3
SAMPLING DEPTH, m	1.5 - 2.1
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	ND, Englobe
SAMPLE DESCRIPTION:	Sandy Silty Clay and Gravel
SAMPLING DATE:	2017-08-24
SAMPLE RECEIVED DATE:	2017-08-24
GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	32.5
% SAND (75 µm to 4.75 mm):	21.0
% Silt (5 µm to 75 µm):	17.7
% Clay (<5 µm):	28.8
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	36.0
37.5	100.0	0.026	33.8
26.5	100.0	0.017	32.9
19.0	100.0	0.010	31.4
13.2	91.1	0.007	30.4
9.5	81.6	0.005	28.8
4.75	67.5	0.003	26.0
2.36	53.8	0.001	20.9
1.18	50.0	ATTERBERG LIMITS, %	
0.60	48.6		
0.30	47.6	Plastic Limit	19.1
0.15	47.2	Liquid Limit	38.3
0.075	46.5	Plastic Index	19.2

PARTICLE SIZE DISTRIBUTION, MTO LS-702



Appendix 4 Environmental Test Results

eurofins | Environment Testing

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10825
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Temperature: 3.6

Dear Nan Du:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: Addrine Thomas 2017.09.01 16:02:16 -04'00'

Addrine Thomas, Inorganics Supervisor

APPROVAL: Charlie Long Qu 2017.09.01 16:27:04 -04'00'

Long Qu, Organics Supervisor

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at http://www.cala.ca/scopes/2602.pdf.

Eurofins (Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

Eurofins (Mississauga) is accredited for specific parameters by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required.

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10825
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316328 Soil Reg153 2017-08-12 BH-1-SS-1	1316329 Soil Reg153 2017-08-12 BH-1-SS-3B	1316330 Soil Reg153 2017-08-12 BH-1-SS-4	1316331 Soil Reg153 2017-08-12 BH-2-SS-1
Inorganics	Antimony	1	ug/g	STD 1.3		<1	1		<1
	Arsenic	1	ug/g	STD 18		4	12		4
	Barium	1	ug/g	STD 220		14	14		1630*
	Beryllium	1	ug/g	STD 2.5		<1	<1		<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5		0.6	<0.5		<0.5
	Boron (total)	5	ug/g	STD 36		16	16		8
	Cadmium	0.5	ug/g	STD 1.2		<0.5	<0.5		<0.5
	Chromium Total	1	ug/g	STD 70		24	13		21
	Cobalt	1	ug/g	STD 22		12	15		12
	Copper	1	ug/g	STD 92		4	48		673*
	Cyanide (CN-)	0.03	ug/g	STD 0.051		<0.03	<0.03		<0.03
	Lead	1	ug/g	STD 120		5	16		204*
	Mercury	0.1	ug/g	STD 0.27		<0.1	<0.1		1.8*
	Molybdenum	1	ug/g	STD 2		1	<1		<1
	Nickel	1	ug/g	STD 82		32	25		20
	Selenium	1	ug/g	STD 1.5		<1	<1		<1
	Silver	0.2	ug/g	STD 0.5		<0.2	0.3		<0.2
	Thallium	1	ug/g	STD 1		<1	<1		<1
	Uranium	0.5	ug/g	STD 2.5		0.8	<0.5		0.7
	Vanadium	2	ug/g	STD 86		28	14		22
	Zinc	2	ug/g	STD 290		55	53		1070*
Misc/Others	Electrical Conductivity	0.05	mS/cm	STD 0.7		0.16	0.23		0.22
	pH - CaCl2	2.0				7.8	7.7		7.7
	Sodium Adsorption Ratio	0.01		STD 5		0.78	0.30		0.12
Moisture	Moisture-Humidite	0.1	%			6.6		2.2	15.9
Petroleum Hydrocarbo	Alpha-androstrane	0	%			94		88	108

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

eurofins | Environment Testing

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10825
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316328 Soil Reg153 2017-08-12 BH-1-SS-1	1316329 Soil Reg153 2017-08-12 BH-1-SS-3B	1316330 Soil Reg153 2017-08-12 BH-1-SS-4	1316331 Soil Reg153 2017-08-12 BH-2-SS-1
Petroleum Hydrocarbons	Petroleum Hydrocarbons F2	10	ug/g	STD 10		<10		<10	<10
	Petroleum Hydrocarbons F3	20	ug/g	STD 240		<20		<20	300*
	Petroleum Hydrocarbons F4	20	ug/g	STD 120		20		<20	150*
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1	10	ug/g	STD 25		<10		<10	<10
	Petroleum Hydrocarbons F1-BTEX	10	ug/g			<10		<10	<10
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g			<0.05		<0.05	<0.05
	Acenaphthene	0.05	ug/g	STD 0.072		<0.05		<0.05	<0.05
	Acenaphthylene	0.05	ug/g	STD 0.093		<0.05		<0.05	<0.05
	Anthracene	0.05	ug/g	STD 0.22		<0.05		<0.05	0.18
	Benz[a]anthracene	0.05	ug/g	STD 0.36		<0.05		<0.05	0.27
	Benzo[a]pyrene	0.05	ug/g	STD 0.3		<0.05		<0.05	0.24
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47		<0.05		<0.05	0.38
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68		<0.05		<0.05	0.15
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48		<0.05		<0.05	0.20
	Chrysene	0.05	ug/g	STD 2.8		<0.05		<0.05	0.31
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1		<0.05		<0.05	0.07
	Fluoranthene	0.05	ug/g	STD 0.69		<0.05		<0.05	0.72*
	Fluorene	0.05	ug/g	STD 0.19		<0.05		<0.05	<0.05
	Indeno[1 2 3-cd]pyrene	0.05	ug/g			<0.05		<0.05	0.16
	Methlynaphthalene, 1-	0.05	ug/g			<0.05		<0.05	<0.05
	Methlynaphthalene, 2-	0.05	ug/g			<0.05		<0.05	<0.05
	Naphthalene	0.05	ug/g	STD 0.09		<0.05		<0.05	<0.05
	Phenanthrene	0.05	ug/g	STD 0.69		<0.05		<0.05	0.46
	Pyrene	0.05	ug/g	STD 1		<0.05		<0.05	0.57
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66		<0.2	<0.2		<0.2
VOCs Surrogates**	1,2-dichloroethane-d4	0	%			110		117	116

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10825
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	1316328 Soil Reg153 2017-08-12 BH-1-SS-1	1316329 Soil Reg153 2017-08-12 BH-1-SS-3B	1316330 Soil Reg153 2017-08-12 BH-1-SS-4	1316331 Soil Reg153 2017-08-12 BH-2-SS-1
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.							
VOCs Surrogates**	4-bromofluorobenzene	0	%		83		80	118
	Toluene-d8	0	%		110		115	87
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50
	Benzene	0.02	ug/g	STD 0.02	<0.02		<0.02	<0.02
	Bromodichloromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Bromoform	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Carbon Tetrachloride	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Chlorobenzene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Chloroform	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dibromochloromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloropropene,1,3-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloropropylene, 1,3-cis-	0.05	ug/g		<0.05		<0.05	<0.05
	Dichloropropylene, 1,3-trans-	0.05	ug/g		<0.05		<0.05	<0.05
	Ethylbenzene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Ethylene dibromide	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Hexane (n)	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10825
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	1316328 Soil Reg153 2017-08-12 BH-1-SS-1	1316329 Soil Reg153 2017-08-12 BH-1-SS-3B	1316330 Soil Reg153 2017-08-12 BH-1-SS-4	1316331 Soil Reg153 2017-08-12 BH-2-SS-1
	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.							
Volatile Organics**	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Methylene Chloride	0.05	ug/g		<0.05		<0.05	<0.05
	Styrene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Toluene	0.20	ug/g	STD 0.2	<0.20		<0.20	<0.20
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichlorofluoromethane	0.05	ug/g	STD 0.25	<0.05		<0.05	<0.05
	Vinyl Chloride	0.02	ug/g	STD 0.02	<0.02		<0.02	<0.02
	Xylene Mixture	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Xylene, m/p-	0.05	ug/g		<0.05		<0.05	<0.05
	Xylene, o-	0.05	ug/g		<0.05		<0.05	<0.05

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316332 Soil Reg153 2017-08-12 BH-2-SS-4	1316333 Soil Reg153 2017-08-12 BH-2-SS-5	1316334 Soil Reg153 2017-08-12 BH-3-SS-1	1316335 Soil Reg153 2017-08-12 BH-3-SS-2
Inorganics	Antimony	1	ug/g	STD 1.3			<1		<1
	Arsenic	1	ug/g	STD 18			5		7
	Barium	1	ug/g	STD 220			122		60
	Beryllium	1	ug/g	STD 2.5			<1		<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5			<0.5		<0.5
	Boron (total)	5	ug/g	STD 36			6		14
	Cadmium	0.5	ug/g	STD 1.2			<0.5		<0.5
	Chromium Total	1	ug/g	STD 70			13		17
	Cobalt	1	ug/g	STD 22			8		9
	Copper	1	ug/g	STD 92			31		35
	Cyanide (CN-)	0.03	ug/g	STD 0.051			<0.03		<0.03
	Lead	1	ug/g	STD 120			7		33
	Mercury	0.1	ug/g	STD 0.27			<0.1		<0.1
	Molybdenum	1	ug/g	STD 2			<1		<1
	Nickel	1	ug/g	STD 82			16		19
	Selenium	1	ug/g	STD 1.5			<1		<1
	Silver	0.2	ug/g	STD 0.5			<0.2		0.2
	Thallium	1	ug/g	STD 1			<1		<1
	Uranium	0.5	ug/g	STD 2.5			<0.5		0.5
	Vanadium	2	ug/g	STD 86			20		17
	Zinc	2	ug/g	STD 290			46		85
Misc/Others	Chloride	0.002	%	STD N/A					0.008
	Electrical Conductivity	0.05	mS/cm	STD 0.7			1.42*		0.56
	pH	2.0							10.7
	pH - CaCl2	2.0					7.8		11.8
	Resistivity	1	ohm-cm						1790

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316332 Soil Reg153 2017-08-12 BH-2-SS-4	1316333 Soil Reg153 2017-08-12 BH-2-SS-5	1316334 Soil Reg153 2017-08-12 BH-3-SS-1	1316335 Soil Reg153 2017-08-12 BH-3-SS-2
Misc/Others	SO4	0.01	%						0.06
	Sodium Adsorption Ratio	0.01		STD 5			0.59		1.41
Moisture**	Moisture-Humidite	0.1	%			21.2		6.2	
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1	10	ug/g	STD 25		<10		<10	
	Petroleum Hydrocarbons F1-BTEX	10	ug/g			<10		<10	
	Petroleum Hydrocarbons F2	10	ug/g	STD 10		<10		<10	
	Petroleum Hydrocarbons F3	20	ug/g	STD 240		<20		60	
	Petroleum Hydrocarbons F4	20	ug/g	STD 120		<20		<20	
PHC Surrogate**	Alpha-androstrane	0	%			86		94	
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g			<0.05		<0.05	
	Acenaphthene	0.05	ug/g	STD 0.072		<0.05		<0.05	
	Acenaphthylene	0.05	ug/g	STD 0.093		<0.05		<0.05	
	Anthracene	0.05	ug/g	STD 0.22		<0.05		<0.05	
	Benz[a]anthracene	0.05	ug/g	STD 0.36		<0.05		<0.05	
	Benzo[a]pyrene	0.05	ug/g	STD 0.3		<0.05		<0.05	
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47		<0.05		<0.05	
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68		<0.05		<0.05	
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48		<0.05		<0.05	
	Chrysene	0.05	ug/g	STD 2.8		<0.05		<0.05	
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1		<0.05		<0.05	
	Fluoranthene	0.05	ug/g	STD 0.69		<0.05		<0.05	
	Fluorene	0.05	ug/g	STD 0.19		<0.05		<0.05	
	Indeno[1 2 3-cd]pyrene	0.05	ug/g			<0.05		<0.05	
	Methlynaphthalene, 1-	0.05	ug/g			<0.05		<0.05	
	Methlynaphthalene, 2-	0.05	ug/g			<0.05		<0.05	
	Naphthalene	0.05	ug/g	STD 0.09		<0.05		<0.05	

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	1316332 Soil Reg153 2017-08-12 BH-2-SS-4	1316333 Soil Reg153 2017-08-12 BH-2-SS-5	1316334 Soil Reg153 2017-08-12 BH-3-SS-1	1316335 Soil Reg153 2017-08-12 BH-3-SS-2
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.							
Semi-Volatiles	Phenanthrene	0.05	ug/g	STD 0.69	<0.05		<0.05	
	Pyrene	0.05	ug/g	STD 1	<0.05		<0.05	
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66		<0.2		<0.2
	REDOX Potential	0	mV					285
	S2-	1	ug/g					1
VOCs Surrogates**	1,2-dichloroethane-d4	0	%		117		117	
	4-bromofluorobenzene	0	%		110		86	
	Toluene-d8	0	%		89		102	
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5	<0.50		<0.50	
	Benzene	0.02	ug/g	STD 0.02	<0.02		<0.02	
	Bromodichloromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Bromoform	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Carbon Tetrachloride	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Chlorobenzene	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Chloroform	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dibromochloromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05	<0.05		<0.05	
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316332 Soil Reg153 2017-08-12 BH-2-SS-4	1316333 Soil Reg153 2017-08-12 BH-2-SS-5	1316334 Soil Reg153 2017-08-12 BH-3-SS-1	1316335 Soil Reg153 2017-08-12 BH-3-SS-2
Volatile Organics**	Dichloropropene,1,3-	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Dichloropropylene, 1,3-cis-	0.05	ug/g			<0.05		<0.05	
	Dichloropropylene, 1,3-trans-	0.05	ug/g			<0.05		<0.05	
	Ethylbenzene	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Ethylene dibromide	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Hexane (n)	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5		<0.50		<0.50	
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5		<0.50		<0.50	
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Methylene Chloride	0.05	ug/g			<0.05		<0.05	
	Styrene	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Tetrachloroethylene	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Toluene	0.20	ug/g	STD 0.2		<0.20		<0.20	
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Trichloroethylene	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Trichlorofluoromethane	0.05	ug/g	STD 0.25		<0.05		<0.05	
	Vinyl Chloride	0.02	ug/g	STD 0.02		<0.02		<0.02	
	Xylene Mixture	0.05	ug/g	STD 0.05		<0.05		<0.05	
	Xylene, m/p-	0.05	ug/g			<0.05		<0.05	
	Xylene, o-	0.05	ug/g			<0.05		<0.05	

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					1316336 Soil Reg153 2017-08-12 BH-4-SS-1	1316337 Soil Reg153 2017-08-12 BH-4-SS-5A	1316338 Soil Reg153 2017-08-12 BH-4-SS-6	1316339 Soil Reg153 2017-08-12 BH-5-SS-1
Inorganics	Antimony	1	ug/g	STD 1.3	<1		<1	<1
	Arsenic	1	ug/g	STD 18	5		4	5
	Barium	1	ug/g	STD 220	85		91	124
	Beryllium	1	ug/g	STD 2.5	<1		<1	<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5	<0.5		<0.5	<0.5
	Boron (total)	5	ug/g	STD 36	7		7	9
	Cadmium	0.5	ug/g	STD 1.2	<0.5		<0.5	<0.5
	Chromium Total	1	ug/g	STD 70	15		19	25
	Cobalt	1	ug/g	STD 22	7		10	13
	Copper	1	ug/g	STD 92	32		24	27
	Cyanide (CN-)	0.03	ug/g	STD 0.051	<0.03		<0.03	<0.03
	Lead	1	ug/g	STD 120	65		7	15
	Mercury	0.1	ug/g	STD 0.27	0.3*		<0.1	<0.1
	Molybdenum	1	ug/g	STD 2	<1		<1	<1
	Nickel	1	ug/g	STD 82	16		22	28
	Selenium	1	ug/g	STD 1.5	<1		<1	<1
	Silver	0.2	ug/g	STD 0.5	<0.2		<0.2	<0.2
	Thallium	1	ug/g	STD 1	<1		<1	<1
	Uranium	0.5	ug/g	STD 2.5	<0.5		0.5	0.6
	Vanadium	2	ug/g	STD 86	18		26	33
	Zinc	2	ug/g	STD 290	100		49	85
Misc/Others	Electrical Conductivity	0.05	mS/cm	STD 0.7	0.22		0.78*	0.22
	pH - CaCl2	2.0			7.7		7.9	7.8
	Sodium Adsorption Ratio	0.01		STD 5	0.11		1.14	0.13
Moisture**	Moisture-Humidite	0.1	%		11.6	19.2		17.0
PHC (Hydrocarbons)	Petroleum Hydrocarbons F1	10	ug/g	STD 25	<10	<10		<10

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316336 Soil Reg153 2017-08-12 BH-4-SS-1	1316337 Soil Reg153 2017-08-12 BH-4-SS-5A	1316338 Soil Reg153 2017-08-12 BH-4-SS-6	1316339 Soil Reg153 2017-08-12 BH-5-SS-1
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1-BTEX	10	ug/g			<10	<10		<10
	Petroleum Hydrocarbons F2	10	ug/g	STD 10		<10	<10		<10
	Petroleum Hydrocarbons F3	20	ug/g	STD 240		<20	<20		<20
	Petroleum Hydrocarbons F4	20	ug/g	STD 120		<20	<20		<20
PHC Surrogate**	Alpha-androstrane	0	%			98	72		86
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g			<0.05	<0.05		<0.05
	Acenaphthene	0.05	ug/g	STD 0.072		<0.05	<0.05		<0.05
	Acenaphthylene	0.05	ug/g	STD 0.093		<0.05	<0.05		<0.05
	Anthracene	0.05	ug/g	STD 0.22		<0.05	<0.05		<0.05
	Benz[a]anthracene	0.05	ug/g	STD 0.36		<0.05	<0.05		<0.05
	Benzo[a]pyrene	0.05	ug/g	STD 0.3		<0.05	<0.05		<0.05
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47		<0.05	<0.05		<0.05
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68		<0.05	<0.05		<0.05
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48		<0.05	<0.05		<0.05
	Chrysene	0.05	ug/g	STD 2.8		<0.05	<0.05		<0.05
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1		<0.05	<0.05		<0.05
	Fluoranthene	0.05	ug/g	STD 0.69		<0.05	<0.05		<0.05
	Fluorene	0.05	ug/g	STD 0.19		<0.05	<0.05		<0.05
	Indeno[1 2 3-cd]pyrene	0.05	ug/g			<0.05	<0.05		<0.05
	Methlynaphthalene, 1-	0.05	ug/g			<0.05	<0.05		<0.05
	Methlynaphthalene, 2-	0.05	ug/g			<0.05	<0.05		<0.05
	Naphthalene	0.05	ug/g	STD 0.09		<0.05	<0.05		<0.05
	Phenanthrene	0.05	ug/g	STD 0.69		<0.05	<0.05		<0.05
	Pyrene	0.05	ug/g	STD 1		<0.05	<0.05		<0.05
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66		<0.2		<0.2	<0.2
VOCs Surrogates**	1,2-dichloroethane-d4	0	%			116	115		118

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	1316336 Soil Reg153 2017-08-12 BH-4-SS-1	1316337 Soil Reg153 2017-08-12 BH-4-SS-5A	1316338 Soil Reg153 2017-08-12 BH-4-SS-6	1316339 Soil Reg153 2017-08-12 BH-5-SS-1
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.							
VOCs Surrogates**	4-bromofluorobenzene	0	%		109	80		89
	Toluene-d8	0	%		88	106		91
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5	<0.50	<0.50		<0.50
	Benzene	0.02	ug/g	STD 0.02	<0.02	<0.02		<0.02
	Bromodichloromethane	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Bromoform	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Carbon Tetrachloride	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Chlorobenzene	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Chloroform	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dibromochloromethane	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichloropropene,1,3-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Dichloropropylene, 1,3-cis-	0.05	ug/g		<0.05	<0.05		<0.05
	Dichloropropylene, 1,3-trans-	0.05	ug/g		<0.05	<0.05		<0.05
	Ethylbenzene	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Ethylene dibromide	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Hexane (n)	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316336 Soil Reg153 2017-08-12 BH-4-SS-1	1316337 Soil Reg153 2017-08-12 BH-4-SS-5A	1316338 Soil Reg153 2017-08-12 BH-4-SS-6	1316339 Soil Reg153 2017-08-12 BH-5-SS-1
Volatile Organics**	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5		<0.50	<0.50		<0.50
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5		<0.50	<0.50		<0.50
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Methylene Chloride	0.05	ug/g			<0.05	<0.05		<0.05
	Styrene	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Tetrachloroethylene	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Toluene	0.20	ug/g	STD 0.2		<0.20	<0.20		<0.20
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Trichloroethylene	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Trichlorofluoromethane	0.05	ug/g	STD 0.25		<0.05	<0.05		<0.05
	Vinyl Chloride	0.02	ug/g	STD 0.02		<0.02	<0.02		<0.02
	Xylene Mixture	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Xylene, m/p-	0.05	ug/g			<0.05	<0.05		<0.05
	Xylene, o-	0.05	ug/g			<0.05	<0.05		<0.05

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316340 Soil Reg153 2017-08-12 BH-5-SS-4	1316341 Soil Reg153 2017-08-12 BH-5-SS-5	1316342 Soil Reg153 2017-08-12 BH-6-SS-2	1316343 Soil Reg153 2017-08-12 BH-6-SS-5
Inorganics	Antimony	1	ug/g	STD 1.3			<1	<1	<1
	Arsenic	1	ug/g	STD 18			4	5	4
	Barium	1	ug/g	STD 220			93	112	114
	Beryllium	1	ug/g	STD 2.5			<1	<1	<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5			0.5	<0.5	0.6
	Boron (total)	5	ug/g	STD 36			8	10	10
	Cadmium	0.5	ug/g	STD 1.2			<0.5	<0.5	<0.5
	Chromium Total	1	ug/g	STD 70			20	23	23
	Cobalt	1	ug/g	STD 22			11	12	11
	Copper	1	ug/g	STD 92			22	22	28
	Cyanide (CN-)	0.03	ug/g	STD 0.051			<0.03	<0.03	<0.03
	Lead	1	ug/g	STD 120			8	9	8
	Mercury	0.1	ug/g	STD 0.27			<0.1	<0.1	<0.1
	Molybdenum	1	ug/g	STD 2			<1	<1	<1
	Nickel	1	ug/g	STD 82			24	26	28
	Selenium	1	ug/g	STD 1.5			<1	<1	<1
	Silver	0.2	ug/g	STD 0.5			<0.2	<0.2	<0.2
	Thallium	1	ug/g	STD 1			<1	<1	<1
	Uranium	0.5	ug/g	STD 2.5			0.6	0.6	0.6
	Vanadium	2	ug/g	STD 86			28	30	31
	Zinc	2	ug/g	STD 290			52	57	54
Misc/Others	Chloride	0.002	%	STD N/A				<0.002	
	Electrical Conductivity	0.05	mS/cm	STD 0.7			0.84*	0.37	1.28*
	pH	2.0						8.2	
	pH - CaCl2	2.0					7.8	8.1	7.8
	Resistivity	1	ohm-cm					2860	

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	1316340 Soil Reg153 2017-08-12 BH-5-SS-4	1316341 Soil Reg153 2017-08-12 BH-5-SS-5	1316342 Soil Reg153 2017-08-12 BH-6-SS-2	1316343 Soil Reg153 2017-08-12 BH-6-SS-5
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.							
Misc/Others	SO4	0.01	%				0.02	
	Sodium Adsorption Ratio	0.01		STD 5		1.10	0.35	1.10
Moisture**	Moisture-Humidite	0.1	%		10.9		15.1	20.8
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1	10	ug/g	STD 25	<10		<10	<10
	Petroleum Hydrocarbons F1-BTEX	10	ug/g		<10		<10	<10
	Petroleum Hydrocarbons F2	10	ug/g	STD 10	<10		<10	<10
	Petroleum Hydrocarbons F3	20	ug/g	STD 240	<20		<20	<20
	Petroleum Hydrocarbons F4	20	ug/g	STD 120	<20		<20	<20
PHC Surrogate**	Alpha-androstrane	0	%		112		84	77
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g		<0.05		<0.05	<0.05
	Acenaphthene	0.05	ug/g	STD 0.072	<0.05		<0.05	<0.05
	Acenaphthylene	0.05	ug/g	STD 0.093	<0.05		<0.05	<0.05
	Anthracene	0.05	ug/g	STD 0.22	<0.05		<0.05	<0.05
	Benz[a]anthracene	0.05	ug/g	STD 0.36	<0.05		<0.05	<0.05
	Benzo[a]pyrene	0.05	ug/g	STD 0.3	<0.05		<0.05	<0.05
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47	<0.05		<0.05	<0.05
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68	<0.05		<0.05	<0.05
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48	<0.05		<0.05	<0.05
	Chrysene	0.05	ug/g	STD 2.8	<0.05		<0.05	<0.05
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1	<0.05		<0.05	<0.05
	Fluoranthene	0.05	ug/g	STD 0.69	<0.05		<0.05	<0.05
	Fluorene	0.05	ug/g	STD 0.19	<0.05		<0.05	<0.05
	Indeno[1 2 3-cd]pyrene	0.05	ug/g		<0.05		<0.05	<0.05
	Methlynaphthalene, 1-	0.05	ug/g		<0.05		<0.05	<0.05
	Methlynaphthalene, 2-	0.05	ug/g		<0.05		<0.05	<0.05
	Naphthalene	0.05	ug/g	STD 0.09	<0.05		<0.05	<0.05

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316340 Soil Reg153 2017-08-12 BH-5-SS-4	1316341 Soil Reg153 2017-08-12 BH-5-SS-5	1316342 Soil Reg153 2017-08-12 BH-6-SS-2	1316343 Soil Reg153 2017-08-12 BH-6-SS-5
Semi-Volatiles	Phenanthrene	0.05	ug/g	STD 0.69		<0.05		<0.05	<0.05
	Pyrene	0.05	ug/g	STD 1		<0.05		<0.05	<0.05
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66			<0.2	<0.2	<0.2
	REDOX Potential	0	mV					341	
	S2-	1	ug/g					<1	
VOCs Surrogates**	1,2-dichloroethane-d4	0	%			116		117	116
	4-bromofluorobenzene	0	%			113		116	97
	Toluene-d8	0	%			89		86	88
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5		<0.50		<0.50	<0.50
	Benzene	0.02	ug/g	STD 0.02		<0.02		<0.02	<0.02
	Bromodichloromethane	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Bromoform	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Carbon Tetrachloride	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Chlorobenzene	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Chloroform	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dibromochloromethane	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05		<0.05		<0.05	<0.05

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	1316340 Soil Reg153 2017-08-12 BH-5-SS-4	1316341 Soil Reg153 2017-08-12 BH-5-SS-5	1316342 Soil Reg153 2017-08-12 BH-6-SS-2	1316343 Soil Reg153 2017-08-12 BH-6-SS-5
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.							
Volatile Organics**	Dichloropropene,1,3-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloropropylene, 1,3-cis-	0.05	ug/g		<0.05		<0.05	<0.05
	Dichloropropylene, 1,3-trans-	0.05	ug/g		<0.05		<0.05	<0.05
	Ethylbenzene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Ethylene dibromide	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Hexane (n)	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Methylene Chloride	0.05	ug/g		<0.05		<0.05	<0.05
	Styrene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Toluene	0.20	ug/g	STD 0.2	<0.20		<0.20	<0.20
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichlorofluoromethane	0.05	ug/g	STD 0.25	<0.05		<0.05	<0.05
	Vinyl Chloride	0.02	ug/g	STD 0.02	<0.02		<0.02	<0.02
	Xylene Mixture	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Xylene, m/p-	0.05	ug/g		<0.05		<0.05	<0.05
	Xylene, o-	0.05	ug/g		<0.05		<0.05	<0.05

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316344 Soil Reg153 2017-08-12 DUP-1	1316345 Soil Reg153 2017-08-12 DUP-2
Inorganics	Antimony	1	ug/g	STD 1.3			<1
	Arsenic	1	ug/g	STD 18			4
	Barium	1	ug/g	STD 220			95
	Beryllium	1	ug/g	STD 2.5			<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5			0.7
	Boron (total)	5	ug/g	STD 36			8
	Cadmium	0.5	ug/g	STD 1.2			<0.5
	Chromium Total	1	ug/g	STD 70			20
	Cobalt	1	ug/g	STD 22			11
	Copper	1	ug/g	STD 92			21
	Cyanide (CN-)	0.03	ug/g	STD 0.051			<0.03
	Lead	1	ug/g	STD 120			8
	Mercury	0.1	ug/g	STD 0.27			<0.1
	Molybdenum	1	ug/g	STD 2			<1
	Nickel	1	ug/g	STD 82			23
	Selenium	1	ug/g	STD 1.5			<1
	Silver	0.2	ug/g	STD 0.5			<0.2
	Thallium	1	ug/g	STD 1			<1
	Uranium	0.5	ug/g	STD 2.5			0.7
	Vanadium	2	ug/g	STD 86			28
	Zinc	2	ug/g	STD 290			50
Misc/Others	Electrical Conductivity	0.05	mS/cm	STD 0.7			0.84*
	pH - CaCl2	2.0					7.8
	Sodium Adsorption Ratio	0.01		STD 5			1.07
Moisture**	Moisture-Humidite	0.1	%			16.9	
PHC (Hydrocarbons)	Petroleum Hydrocarbons F1	10	ug/g	STD 25		<10	

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	1316344 Soil Reg153 2017-08-12 DUP-1	1316345 Soil Reg153 2017-08-12 DUP-2
	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.					
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1-BTEX	10	ug/g		<10	
	Petroleum Hydrocarbons F2	10	ug/g	STD 10	<10	
	Petroleum Hydrocarbons F3	20	ug/g	STD 240	<20	
	Petroleum Hydrocarbons F4	20	ug/g	STD 120	<20	
PHC Surrogate**	Alpha-androstrane	0	%		86	
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g		<0.05	
	Acenaphthene	0.05	ug/g	STD 0.072	<0.05	
	Acenaphthylene	0.05	ug/g	STD 0.093	<0.05	
	Anthracene	0.05	ug/g	STD 0.22	<0.05	
	Benz[a]anthracene	0.05	ug/g	STD 0.36	<0.05	
	Benzo[a]pyrene	0.05	ug/g	STD 0.3	<0.05	
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47	<0.05	
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68	<0.05	
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48	<0.05	
	Chrysene	0.05	ug/g	STD 2.8	<0.05	
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1	<0.05	
	Fluoranthene	0.05	ug/g	STD 0.69	<0.05	
	Fluorene	0.05	ug/g	STD 0.19	<0.05	
	Indeno[1 2 3-cd]pyrene	0.05	ug/g		<0.05	
	Methlynaphthalene, 1-	0.05	ug/g		<0.05	
	Methlynaphthalene, 2-	0.05	ug/g		<0.05	
	Naphthalene	0.05	ug/g	STD 0.09	<0.05	
	Phenanthrene	0.05	ug/g	STD 0.69	<0.05	
	Pyrene	0.05	ug/g	STD 1	<0.05	
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66		<0.2
VOCs Surrogates**	1,2-dichloroethane-d4	0	%		117	

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	1316344 Soil Reg153 2017-08-12 DUP-1	1316345 Soil Reg153 2017-08-12 DUP-2
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.					
VOCs Surrogates**	4-bromofluorobenzene	0	%		113	
	Toluene-d8	0	%		89	
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5	<0.50	
	Benzene	0.02	ug/g	STD 0.02	<0.02	
	Bromodichloromethane	0.05	ug/g	STD 0.05	<0.05	
	Bromoform	0.05	ug/g	STD 0.05	<0.05	
	Carbon Tetrachloride	0.05	ug/g	STD 0.05	<0.05	
	Chlorobenzene	0.05	ug/g	STD 0.05	<0.05	
	Chloroform	0.05	ug/g	STD 0.05	<0.05	
	Dibromochloromethane	0.05	ug/g	STD 0.05	<0.05	
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05	<0.05	
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05	<0.05	
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05	<0.05	
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05	<0.05	
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05	<0.05	
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05	<0.05	
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05	<0.05	
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05	<0.05	
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05	<0.05	
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05	<0.05	
	Dichloropropene,1,3-	0.05	ug/g	STD 0.05	<0.05	
	Dichloropropylene, 1,3-cis-	0.05	ug/g		<0.05	
	Dichloropropylene, 1,3-trans-	0.05	ug/g		<0.05	
	Ethylbenzene	0.05	ug/g	STD 0.05	<0.05	
	Ethylene dibromide	0.05	ug/g	STD 0.05	<0.05	
	Hexane (n)	0.05	ug/g	STD 0.05	<0.05	

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316344 Soil Reg153 2017-08-12 DUP-1	1316345 Soil Reg153 2017-08-12 DUP-2
Volatile Organics**	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5		<0.50	
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5		<0.50	
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05		<0.05	
	Methylene Chloride	0.05	ug/g			<0.05	
	Styrene	0.05	ug/g	STD 0.05		<0.05	
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05		<0.05	
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05		<0.05	
	Tetrachloroethylene	0.05	ug/g	STD 0.05		<0.05	
	Toluene	0.20	ug/g	STD 0.2		<0.20	
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05		<0.05	
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05		<0.05	
	Trichloroethylene	0.05	ug/g	STD 0.05		<0.05	
	Trichlorofluoromethane	0.05	ug/g	STD 0.25		<0.05	
	Vinyl Chloride	0.02	ug/g	STD 0.02		<0.02	
	Xylene Mixture	0.05	ug/g	STD 0.05		<0.05	
	Xylene, m/p-	0.05	ug/g			<0.05	
	Xylene, o-	0.05	ug/g			<0.05	

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 325094 **Analysis/Extraction Date** 2017-09-01 **Instrument**			
Method SUBCONTRACT P-INORG **Analyst** SDC			
Chromium VI	<0.2 ug/g	100	80-120
Run No 332261 **Analysis/Extraction Date** 2017-08-28 **Instrument** pH Meter			
Method Ag Soil **Analyst** R E			
pH		100	90-110
pH - CaCl2			90-110
Method Cond-Soil **Analyst** R E			
Electrical Conductivity		99	85-115
Method Resistivity - soil **Analyst** R E			
Resistivity			
Run No 332265 **Analysis/Extraction Date** 2017-08-28 **Instrument** Manual			
Method C CSA A23.2-4B **Analyst** C F			
Chloride		100	90-110
Run No 332276 **Analysis/Extraction Date** 2017-08-28 **Instrument** Electrical Conductivity Mete			

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Method Cond-Soil	**Analyst** AJS		
Electrical Conductivity	<0.05 mS/cm	100	85-115
Run No 332278 **Analysis/Extraction Date** 2017-08-28	**Instrument** Skalar CN Analyzer		
Method C SM4500-CNC	**Analyst** C F		
Cyanide (CN-)	<0.03 ug/g	112	75-125
Run No 332321 **Analysis/Extraction Date** 2017-08-28	**Instrument** GC/MS		
Method EPA 8260	**Analyst** JYL		
Tetrachloroethane, 1,1,1,2-	<0.05 ug/g	100	80-120
Trichloroethane, 1,1,1-	<0.05 ug/g	101	80-120
Tetrachloroethane, 1,1,2,2-	<0.05 ug/g	116	80-120
Trichloroethane, 1,1,2-	<0.05 ug/g	100	80-120
Dichloroethane, 1,1-	<0.05 ug/g	118	80-120
Dichloroethylene, 1,1-	<0.05 ug/g	103	80-120
Dichlorobenzene, 1,2-	<0.05 ug/g	113	80-120
Dichloroethane, 1,2-	<0.05 ug/g	105	80-120
Dichloropropane, 1,2-	<0.05 ug/g	98	80-120
Dichlorobenzene, 1,3-	<0.05 ug/g	105	80-120
Dichloropropene,1,3-	<0.05 ug/g		
Dichlorobenzene, 1,4-	<0.05 ug/g	110	80-120

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Acetone	<0.50 ug/g	91	70-130
Benzene	<0.02 ug/g	100	60-130
Bromodichloromethane	<0.05 ug/g	102	80-120
Bromoform	<0.05 ug/g	106	60-130
Dichloroethylene, 1,2-cis-	<0.05 ug/g	101	80-120
Dichloropropene,1,3-cis-	<0.05 ug/g	91	80-120
Carbon Tetrachloride	<0.05 ug/g	100	80-120
Chloroform	<0.05 ug/g	106	80-120
Dibromochloromethane	<0.05 ug/g	98	80-120
Dichlorodifluoromethane	<0.05 ug/g	116	70-130
Methylene Chloride	<0.05 ug/g	102	70-130
Ethylbenzene	<0.05 ug/g	89	80-120
Ethylene dibromide	<0.05 ug/g	99	80-120
Hexane (n)	<0.05 ug/g	81	70-130
m/p-xylene	<0.05 ug/g	96	80-120
Methyl Ethyl Ketone	<0.50 ug/g	94	70-130
Methyl Isobutyl Ketone	<0.50 ug/g	86	70-130
Methyl tert-Butyl Ether (MTBE)	<0.05 ug/g	101	70-130

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Chlorobenzene	<0.05 ug/g	94	80-120
o-xylene	<0.05 ug/g	96	80-120
Styrene	<0.05 ug/g	90	80-120
Dichloroethylene, 1,2-trans-	<0.05 ug/g	90	80-120
Dichloropropene,1,3-trans-	<0.05 ug/g	102	80-120
Tetrachloroethylene	<0.05 ug/g	99	80-120
Toluene	<0.20 ug/g	90	80-120
Trichloroethylene	<0.05 ug/g	98	80-120
Trichlorofluoromethane	<0.05 ug/g	114	70-130
Vinyl Chloride	<0.02 ug/g	119	80-120
Xylene Mixture	<0.05 ug/g		
Run No 332324 **Analysis/Extraction Date** 2017-08-28 **Instrument** GC/FID			
Method CCME **Analyst** JYL			
Petroleum Hydrocarbons F1	<10 ug/g	95	80-120
Petroleum Hydrocarbons F1-BTEX	<10 ug/g		
Run No 332346 **Analysis/Extraction Date** 2017-08-29 **Instrument** iCAP OES			
Method Ag Soil **Analyst** H F			
Sodium Adsorption Ratio	<0.01		

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 332411 **Analysis/Extraction Date** 2017-08-30 **Instrument** Manual			
Method AG SOIL **Analyst** C F			
SO4	<0.01 %	100	70-130
Run No 332414 **Analysis/Extraction Date** 2017-08-29 **Instrument**			
Method P 8270 **Analyst** JLD			
Methlynaphthalene, 1-	<0.05 ug/g	71	50-140
Methlynaphthalene, 2-	<0.05 ug/g	73	50-140
Acenaphthene	<0.05 ug/g	68	50-140
Acenaphthylene	<0.05 ug/g	63	50-140
Anthracene	<0.05 ug/g	73	50-140
Benz[a]anthracene	<0.05 ug/g	83	50-140
Benzo[a]pyrene	<0.05 ug/g	81	50-140
Benzo[b]fluoranthene	<0.05 ug/g	124	50-140
Benzo[ghi]perylene	<0.05 ug/g	83	50-140
Benzo[k]fluoranthene	<0.05 ug/g	89	50-140
Chrysene	<0.05 ug/g	81	50-140
Dibenz[a h]anthracene	<0.05 ug/g	83	50-140
Fluoranthene	<0.05 ug/g	81	50-140

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Fluorene	<0.05 ug/g	69	50-140
Indeno[1 2 3-cd]pyrene	<0.05 ug/g	89	50-140
Naphthalene	<0.05 ug/g	67	50-140
Phenanthrene	<0.05 ug/g	79	50-140
Pyrene	<0.05 ug/g	80	50-140
Run No 332416 **Analysis/Extraction Date** 2017-08-29 **Instrument**			
Method P 8270 **Analyst** JLD			
1+2-methylnaphthalene	<0.05 ug/g		
Run No 332438 **Analysis/Extraction Date** 2017-08-30 **Instrument** iCAP OES			
Method Boron HWE **Analyst** H F			
Boron (Hot Water Soluble)	<0.5 ug/g	91	70-130
Run No 332450 **Analysis/Extraction Date** 2017-08-30 **Instrument** Oven			
Method C SM2540B **Analyst** JLD			
Moisture-Humidite		100	80-120
Method CCME **Analyst** JLD			
Petroleum Hydrocarbons F2	<10 ug/g	116	80-120
Petroleum Hydrocarbons F3	<20 ug/g	116	80-120
Petroleum Hydrocarbons F4	<20 ug/g	116	80-120
Run No 332457 **Analysis/Extraction Date** 2017-08-30 **Instrument** Cetac Hg Analyzer			

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Method M SM3112B-3500B	**Analyst** AJS		
Mercury	<0.1 ug/g	96	80-120
Run No 332467	**Analysis/Extraction Date** 2017-08-29	**Instrument**	
Method P 8270	**Analyst** JLD		
Methlynaphthalene, 1-	<0.05 ug/g	71	50-140
Methlynaphthalene, 2-	<0.05 ug/g	73	50-140
Acenaphthene	<0.05 ug/g	68	50-140
Acenaphthylene	<0.05 ug/g	63	50-140
Anthracene	<0.05 ug/g	73	50-140
Benz[a]anthracene	<0.05 ug/g	83	50-140
Benzo[a]pyrene	<0.05 ug/g	81	50-140
Benzo[b]fluoranthene	<0.05 ug/g	124	50-140
Benzo[ghi]perylene	<0.05 ug/g	83	50-140
Benzo[k]fluoranthene	<0.05 ug/g	89	50-140
Chrysene	<0.05 ug/g	81	50-140
Dibenz[a h]anthracene	<0.05 ug/g	83	50-140
Fluoranthene	<0.05 ug/g	81	50-140
Fluorene	<0.05 ug/g	69	50-140

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1
2395 Speakman Drive, Mississauga, ON, L5K 1B3

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Indeno[1 2 3-cd]pyrene	<0.05 ug/g	89	50-140
Naphthalene	<0.05 ug/g	67	50-140
Phenanthrene	<0.05 ug/g	79	50-140
Pyrene	<0.05 ug/g	80	50-140
Run No 332468 **Analysis/Extraction Date** 2017-08-30 **Instrument**			
Method EPA 200.8 **Analyst** H D			
Silver	<0.2 ug/g	106	70-130
Arsenic	<1 ug/g	96	70-130
Boron (total)	<5 ug/g	98	70-130
Barium	<1 ug/g	98	70-130
Beryllium	<1 ug/g	98	70-130
Cadmium	<0.5 ug/g	107	70-130
Cobalt	<1 ug/g	102	70-130
Chromium Total	<1 ug/g	101	70-130
Copper	<1 ug/g	104	70-130
Molybdenum	<1 ug/g	95	70-130
Nickel	<1 ug/g	104	70-130
Lead	<1 ug/g	103	70-130

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Antimony	<1 ug/g	90	70-130
Selenium	<1 ug/g	98	70-130
Thallium	<1 ug/g	103	70-130
Uranium	<0.5 ug/g	102	70-130
Vanadium	<2 ug/g	99	70-130
Zinc	<2 ug/g	108	70-130
Run No 332513 **Analysis/Extraction Date** 2017-08-28 **Instrument**			
Method SUBCONTRACT-SA-INORG **Analyst** AET			
REDOX Potential		100	
S2-			
Run No 332535 **Analysis/Extraction Date** 2017-08-31 **Instrument** GC/FID			
Method CCME **Analyst** S V			
Petroleum Hydrocarbons F2	<10 ug/g	75	80-120
Petroleum Hydrocarbons F3	<20 ug/g	75	80-120
Petroleum Hydrocarbons F4	<20 ug/g	75	80-120
Method MOISTURE MISS **Analyst** S V			
Moisture-Humidite	<0.1 %		
Run No 332571 **Analysis/Extraction Date** 2017-08-31 **Instrument**			
Method EPA 200.8 **Analyst** H D			

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716238
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821408

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Boron (total)	<5 ug/g	90	70-130

Guideline = O.Reg 153-T8-Res/Com *** = Guideline Exceedence**

*All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10825
Invoice to: EnGlobe Corp.

Report Number: 1716239
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821409

Dear Nan Du:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: Addrine Thomas 2017.09.01 11:53:55 -04'00'
Addrine Thomas, Inorganics Supervisor

APPROVAL: Charlie Long Qu 2017.09.01 15:35:58 -04'00'
Long Qu, Organics Supervisor

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at http://www.cala.ca/scopes/2602.pdf.

Eurofins(Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

Eurofins(Mississauga) is accredited for specific parameters by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required.

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10825
Invoice to: EnGlobe Corp.

Report Number: 1716239
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821409

Group	Analyte	MRL	Units	Guideline	1316346 REG 347 LCH Soil 2017-08-23 TCLP-1	1316347 REG 347 LCH Soil 2017-08-23 TCLP-2
	Lab I.D.				1316346	1316347
	Sample Matrix				REG 347 LCH	REG 347 LCH
	Sample Type				Soil	Soil
	Sampling Date				2017-08-23	2017-08-23
	Sample I.D.				TCLP-1	TCLP-2
Cyanide	Cyanide (free)	0.05	mg/L	LQC 20.0	<0.05	<0.05
General Chemistry	F	0.10	mg/L	LQC 150.0	0.24	0.23
	Moisture-Humidite	0.1	%		11.0	17.9
	NO2 + NO3 as N	0.10	mg/L	LQC 1000.0	<0.10	<0.10
Mercury	Hg	0.001	mg/L	LQC 0.1	<0.001	<0.001
Metals	Ag	0.01	mg/L	LQC 5	<0.01	<0.01
	As	0.02	mg/L	LQC 2.5	<0.02	<0.02
	B	0.1	mg/L	LQC 500.0	<0.1	<0.1
	Ba	0.01	mg/L	LQC 100.0	0.79	0.59
	Cd	0.008	mg/L	LQC 0.5	<0.008	<0.008
	Cr	0.05	mg/L	LQC 5.0	<0.05	<0.05
	Pb	0.01	mg/L	LQC 5.0	<0.01	<0.01
	Se	0.02	mg/L	LQC 1.0	<0.02	<0.02
	U	0.01	mg/L	LQC 10.0	<0.01	<0.01
Others	REG 558 Leach				Y	Y
	Zero Headspace Extraction				Y	Y
VOCs	1,1-dichloroethylene	0.0005	mg/L	LQC 1.4	<0.0005	<0.0005
	1,2-dichlorobenzene	0.0004	mg/L	LQC 20.0	<0.0004	<0.0004
	1,2-dichloroethane	0.0002	mg/L	LQC 0.5	<0.0002	<0.0002
	1,4-dichlorobenzene	0.0004	mg/L	LQC 0.5	<0.0004	<0.0004
	Benzene	0.0005	mg/L	LQC 0.5	<0.0005	<0.0005
	Carbon Tetrachloride	0.0002	mg/L	LQC 0.5	<0.0002	<0.0002
	Chloroform	0.0005	mg/L	LQC 10.0	<0.0005	<0.0005
	Dichloromethane	0.004	mg/L	LQC 5.0	<0.004	<0.004
	Methyl Ethyl Ketone (MEK)	0.01	mg/L	LQC 200.0	<0.01	<0.01

Guideline = REG 558 (mg/L) *** = Guideline Exceedence**

All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10825
Invoice to: EnGlobe Corp.

Report Number: 1716239
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821409

Group	Analyte	MRL	Units	Guideline	1316346 REG 347 LCH Soil 2017-08-23 TCLP-1	1316347 REG 347 LCH Soil 2017-08-23 TCLP-2
	Lab I.D.				1316346	1316347
	Sample Matrix				REG 347 LCH	REG 347 LCH
	Sample Type				Soil	Soil
	Sampling Date				2017-08-23	2017-08-23
	Sample I.D.				TCLP-1	TCLP-2
VOCs	Monochlorobenzene	0.0002	mg/L	LQC 8.0	<0.0002	<0.0002
	Tetrachloroethylene	0.0003	mg/L	LQC 3.0	<0.0003	<0.0003
	Trichloroethylene	0.0003	mg/L	LQC 5.0	<0.0003	<0.0003
	Vinyl Chloride	0.0002	mg/L	LQC 0.2	<0.0002	<0.0002
VOCs Surrogates (%REC)	1,2-dichloroethane-d4	0	%		114	102
	4-bromofluorobenzene	0	%		106	101
	Toluene-d8	0	%		95	96

Guideline = REG 558 (mg/L) *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716239
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821409

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 290004 **Analysis/Extraction Date** 2017-08-30 **Analyst** TJB			
Method V 8260B			
Methyl Ethyl Ketone	<0.01 mg/L	108	60-130
Run No 332345 **Analysis/Extraction Date** 2017-08-29 **Analyst** H F			
Method C MOEE Reg 347			
REG 558 Leach			
Zero Headspace Extraction			
Method C SM2540B			
Moisture-Humidite			80-120
Run No 332411 **Analysis/Extraction Date** 2017-08-30 **Analyst** C F			
Method C SM4500-CNC			
Cyanide (CN-)	<0.05 mg/L	104	75-125
Run No 332448 **Analysis/Extraction Date** 2017-08-30 **Analyst** H D			
Method SM 4500-FC			
F	<0.10 mg/L	101	90-110
Run No 332452 **Analysis/Extraction Date** 2017-08-29 **Analyst** H D			
Method C SM4500-NO3-F			
NO2 + NO3 as N	<0.10 mg/L	96	80-120

Guideline = REG 558 (mg/L) *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716239
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821409

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 332458 **Analysis/Extraction Date** 2017-08-30 **Analyst** AJS			
Method M SM3112B-3500B			
Mercury	<0.001 mg/L	95	76-123
Run No 332480 **Analysis/Extraction Date** 2017-08-30 **Analyst** H D			
Method SM 4500-FC			
F	<0.10 mg/L	101	90-110
Run No 332498 **Analysis/Extraction Date** 2017-08-29 **Analyst** TJB			
Method V 8260B			
Dichloroethylene, 1,1-	<0.0005 mg/L	112	60-130
Dichlorobenzene, 1,2-	<0.0004 mg/L	116	60-130
Dichloroethane, 1,2-	<0.0002 mg/L	104	60-130
Dichlorobenzene, 1,4-	<0.0004 mg/L	98	60-130
Benzene	<0.0005 mg/L	105	60-130
Carbon Tetrachloride	<0.0002 mg/L	106	60-130
Chloroform	<0.0005 mg/L	103	60-130
Methylene Chloride	<0.004 mg/L	97	60-130
Chlorobenzene	<0.0002 mg/L	102	60-130
Tetrachloroethylene	<0.0003 mg/L	104	60-130

Guideline = REG 558 (mg/L) *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#:
Invoice to: EnGlobe Corp.

Report Number: 1716239
Date Submitted: 2017-08-25
Date Reported: 2017-09-01
Project: B-0017786
COC #: 821409

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Trichloroethylene	<0.0003 mg/L	104	60-130
Vinyl Chloride	<0.0002 mg/L	108	60-130
Run No 332570 **Analysis/Extraction Date** 2017-08-31 **Analyst** H D			
Method EPA 200.8			
Silver	<0.01 mg/L	100	70-130
Arsenic	<0.02 mg/L	99	70-130
Boron (total)	<0.1 mg/L	73	70-130
Barium	<0.01 mg/L	103	70-130
Cadmium	<0.008 mg/L	111	70-130
Chromium Total	<0.05 mg/L	103	70-130
Lead	<0.01 mg/L	102	70-130
Selenium	<0.02 mg/L	99	70-130
Uranium	<0.01 mg/L	91	70-130

Guideline = REG 558 (mg/L) *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

Dear Nan Du:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: Addrine Thomas 2017.09.13 13:15:52 -04'00'
Addrine Thomas, Inorganics Supervisor

APPROVAL: Charlie Long Qu 2017.09.13 13:30:22 -04'00'
Long Qu, Organics Supervisor

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at http://www.cala.ca/scopes/2602.pdf.

Eurofins(Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

Eurofins(Mississauga) is accredited for specific parameters by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required.

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1319057 GW (Reg 153) 2017-09-06 BH/MW-6	1319058 GW (Reg 153) 2017-09-06 DUP-1	1319059 GW (Reg 153) 2017-09-06 Trip Blank
Cyanide	Cyanide (free)	5	ug/L	STD 5		<5	<5	
General Chemistry	Cl	1000	ug/L	STD 790000		194000	186000	
	Conductivity	5	uS/cm			4630	4640	
	pH	1.00				7.67	7.65	
Mercury	Hg	0.0001	ug/L	STD 0.1		<0.0001	<0.0001	
Metals	Ag	0.1	ug/L	STD 0.3		<0.1	<0.1	
	As	1	ug/L	STD 13		<1	<1	
	B	10	ug/L	STD 1700		340	340	
	Ba	10	ug/L	STD 610		40	40	
	Be	0.5	ug/L	STD 0.5		<0.5	<0.5	
	Cd	0.1	ug/L	STD 0.5		<0.1	<0.1	
	Co	0.2	ug/L	STD 3.8		7.7*	7.8*	
	Cr	1	ug/L	STD 11		<1	<1	
	Cr(VI)	10	ug/L	STD 25		<10	<10	
	Cu	1	ug/L	STD 5		14*	14*	
	Mo	5	ug/L	STD 23		<5	<5	
	Na	2000	ug/L	STD 490000		224000	249000	
	Ni	5	ug/L	STD 14		11	11	
	Pb	1	ug/L	STD 1.9		<1	<1	
	Sb	0.5	ug/L	STD 1.5		<0.5	<0.5	
	Se	1	ug/L	STD 5		<1	<1	
	Tl	0.1	ug/L	STD 0.5		<0.1	<0.1	
	U	1	ug/L	STD 8.9		19*	19*	
	V	1	ug/L	STD 3.9		2	2	
	Zn	10	ug/L	STD 160		<10	<10	

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**

All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

Group	Analyte	MRL	Units	Guideline	1319057 GW (Reg 153) 2017-09-06 BH/MW-6	1319058 GW (Reg 153) 2017-09-06 DUP-1	1319059 GW (Reg 153) 2017-09-06 Trip Blank
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.						
Others	Alpha-androstrane	0	%		96	106	
	F1 (C6-C10)	20	ug/L	STD 420	<20	<20	
	F2 (C10-C16)	20	ug/L	STD 150	<20	<20	
	F3 (C16-C34)	50	ug/L	STD 500	<50	<50	
	F4 (C34-C50)	50	ug/L	STD 500	<50	<50	
Semi-Volatiles	1+2-methylnaphthalene	0.1	ug/L		<0.1	<0.1	
	1-methylnaphthalene	0.1	ug/L	STD 2	<0.1	<0.1	
	2-methylnaphthalene	0.1	ug/L	STD 2	<0.1	<0.1	
	Acenaphthene	0.1	ug/L	STD 4.1	<0.1	<0.1	
	Acenaphthylene	0.1	ug/L	STD 1	<0.1	<0.1	
	Anthracene	0.1	ug/L	STD 0.1	<0.1	<0.1	
	Benzo(a)anthracene	0.1	ug/L	STD 0.2	<0.1	<0.1	
	Benzo(a)pyrene	0.01	ug/L	STD 0.01	<0.01	<0.01	
	Benzo(b)fluoranthene	0.05	ug/L	STD 0.1	<0.05	<0.05	
	Benzo(g,h,i)perylene	0.1	ug/L	STD 0.2	<0.1	<0.1	
	Benzo(k)fluoranthene	0.05	ug/L	STD 0.1	<0.05	<0.05	
	Chrysene	0.05	ug/L	STD 0.1	<0.05	<0.05	
	Dibenzo(a,h)anthracene	0.1	ug/L	STD 0.2	<0.1	<0.1	
	Fluoranthene	0.1	ug/L	STD 0.4	<0.1	<0.1	
	Fluorene	0.1	ug/L	STD 120	<0.1	<0.1	
	Indeno(1,2,3-c,d)pyrene	0.1	ug/L	STD 0.2	<0.1	<0.1	
	Naphthalene	0.1	ug/L	STD 7	<0.1	<0.1	
	Phenanthrene	0.1	ug/L	STD 0.1	<0.1	<0.1	
	Pyrene	0.1	ug/L	STD 0.2	<0.1	<0.1	
VOCs	1,1,1,2-tetrachloroethane	0.5	ug/L	STD 1.1	<0.5	<0.5	<0.5

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**

All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

Group	Analyte	MRL	Units	Guideline	1319057 GW (Reg 153) 2017-09-06 BH/MW-6	1319058 GW (Reg 153) 2017-09-06 DUP-1	1319059 GW (Reg 153) 2017-09-06 Trip Blank
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.						
VOCs	1,1,1-trichloroethane	0.4	ug/L	STD 0.5	<0.4	<0.4	<0.4
	1,1,2,2-tetrachloroethane	0.5	ug/L	STD 0.5	<0.5	<0.5	<0.5
	1,1,2-trichloroethane	0.4	ug/L	STD 0.5	<0.4	<0.4	<0.4
	1,1-dichloroethane	0.4	ug/L	STD 0.5	<0.4	<0.4	<0.4
	1,1-dichloroethylene	0.5	ug/L	STD 0.5	<0.5	<0.5	<0.5
	1,2-dichlorobenzene	0.4	ug/L	STD 0.5	<0.4	<0.4	<0.4
	1,2-dichloroethane	0.2	ug/L	STD 0.5	<0.2	<0.2	<0.2
	1,2-dichloropropane	0.5	ug/L	STD 0.5	<0.5	<0.5	<0.5
	1,3,5-trimethylbenzene	0.3	ug/L		<0.3	<0.3	<0.3
	1,3-dichlorobenzene	0.4	ug/L	STD 0.5	<0.4	<0.4	<0.4
	1,3-Dichloropropylene (cis+trans)	0.3	ug/L	STD 0.5	<0.3	<0.3	<0.3
	1,4-dichlorobenzene	0.4	ug/L	STD 0.5	<0.4	<0.4	<0.4
	Acetone	30	ug/L	STD 2700	<30	<30	<30
	Benzene	0.5	ug/L	STD 0.5	<0.5	<0.5	<0.5
	Bromodichloromethane	0.3	ug/L	STD 2	<0.3	<0.3	<0.3
	Bromoform	0.4	ug/L	STD 5	<0.4	<0.4	<0.4
	Bromomethane	0.5	ug/L	STD 0.89	<0.5	<0.5	<0.5
	c-1,2-Dichloroethylene	0.4	ug/L	STD 1.6	<0.4	<0.4	<0.4
	c-1,3-Dichloropropylene	0.2	ug/L		<0.2	<0.2	<0.2
	Carbon Tetrachloride	0.2	ug/L	STD 0.2	<0.2	<0.2	<0.2
	Chloroethane	0.2	ug/L		<0.2	<0.2	<0.2
	Chloroform	0.5	ug/L	STD 2	<0.5	<0.5	<0.5
	Dibromochloromethane	0.3	ug/L	STD 2	<0.3	<0.3	<0.3
	Dichlorodifluoromethane	0.5	ug/L	STD 590	<0.5	<0.5	<0.5
	Dichloromethane	4.0	ug/L	STD 5	<4.0	<4.0	<4.0

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**

All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

Group	Analyte	MRL	Units	Guideline	1319057 GW (Reg 153) 2017-09-06 BH/MW-6	1319058 GW (Reg 153) 2017-09-06 DUP-1	1319059 GW (Reg 153) 2017-09-06 Trip Blank
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.						
VOCs	Ethylbenzene	0.5	ug/L	STD 0.5	<0.5	<0.5	<0.5
	Ethylene Dibromide	0.2	ug/L	STD 0.2	<0.2	<0.2	<0.2
	Hexane	5	ug/L	STD 5	<5	<5	<5
	m/p-xylene	0.4	ug/L		<0.4	<0.4	<0.4
	Methyl Ethyl Ketone (MEK)	10	ug/L	STD 400	<10	<10	<10
	Methyl Isobutyl Ketone (MIBK)	10	ug/L	STD 640	<10	<10	<10
	Methyl Tert Butyl Ether (MTBE)	2	ug/L	STD 15	<2	<2	<2
	Monochlorobenzene	0.2	ug/L	STD 0.5	<0.2	<0.2	<0.2
	o-xylene	0.4	ug/L		<0.4	<0.4	<0.4
	Styrene	0.5	ug/L	STD 0.5	<0.5	<0.5	<0.5
	t-1,2-Dichloroethylene	0.4	ug/L	STD 1.6	<0.4	<0.4	<0.4
	t-1,3-Dichloropropylene	0.2	ug/L		<0.2	<0.2	<0.2
	Tetrachloroethylene	0.3	ug/L	STD 0.5	<0.3	<0.3	<0.3
	Toluene	0.5	ug/L	STD 0.8	<0.5	<0.5	<0.5
	Trichloroethylene	0.3	ug/L	STD 0.5	<0.3	<0.3	<0.3
	Trichlorofluoromethane	0.5	ug/L	STD 150	<0.5	<0.5	<0.5
	Vinyl Chloride	0.2	ug/L	STD 0.5	<0.2	<0.2	<0.2
	Xylene; total	0.5	ug/L	STD 72	<0.5	<0.5	<0.5
VOCs Surrogates (%REC)	1,2-dichloroethane-d4	0	%		98	93	103
	4-bromofluorobenzene	0	%		119	105	104
	Toluene-d8	0	%		95	98	94

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**

All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 290004 **Analysis/Extraction Date** 2017-09-11 **Analyst** TJB			
Method CCME O.Reg 153/04			
Petroleum Hydrocarbons F1	<20 ug/L	84	60-140
Method V 8260B			
Dichloropropene,1,3-			
Acetone	<30 ug/L	117	60-130
Methyl Ethyl Ketone	<10 ug/L	111	60-130
Methyl Isobutyl Ketone	<10 ug/L	102	60-130
Methyl tert-Butyl Ether (MTBE)	<2 ug/L	113	60-130
Run No 332900 **Analysis/Extraction Date** 2017-09-07 **Analyst** JLD			
Method CCME O.Reg 153/04			
Petroleum Hydrocarbons F2	<20 ug/L	100	60-140
Petroleum Hydrocarbons F3	<50 ug/L	100	60-140
Petroleum Hydrocarbons F4	<50 ug/L	100	60-140
Run No 332909 **Analysis/Extraction Date** 2017-09-07 **Analyst** SKH			
Method EPA 200.8			
Silver	<0.1 ug/L	107	89-111
Arsenic	<1 ug/L	104	91.7-108.2

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**

All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Boron (total)	<10 ug/L	106	84.9-115
Barium	<10 ug/L	98	93.4-106.5
Beryllium	<0.5 ug/L	105	89.5-110.4
Cadmium	<0.1 ug/L	103	93.5-106.4
Cobalt	<0.2 ug/L	104	92.7-107.2
Chromium Total	<1 ug/L	102	94-106
Copper	<1 ug/L	101	92.4-107.6
Molybdenum	<5 ug/L	100	92.8-107.2
Nickel	<5 ug/L	104	93-106.9
Lead	<1 ug/L	101	92.4-107.5
Antimony	<0.5 ug/L	105	89.6-110.3
Selenium	<1 ug/L	98	87.4-112.6
Thallium	<0.1 ug/L	102	90.4-109.5
Uranium	<1 ug/L	101	92.7-107.2
Vanadium	<1 ug/L	104	93-106.9
Zinc	<10 ug/L	101	91.5-108.4

Run No 332958 **Analysis/Extraction Date** 2017-09-08 **Analyst** H D

Method SM 2510B

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**

All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Conductivity	<5 uS/cm	99	90-110
Method SM 4500-H+B			
pH	6.59	100	90-110
Run No 332976 **Analysis/Extraction Date** 2017-09-07 **Analyst** TJB			
Method V 8260B			
Tetrachloroethane, 1,1,1,2-	<0.5 ug/L	118	60-130
Trichloroethane, 1,1,1-	<0.4 ug/L	115	60-130
Tetrachloroethane, 1,1,2,2-	<0.5 ug/L	109	60-130
Trichloroethane, 1,1,2-	<0.4 ug/L	98	60-130
Dichloroethane, 1,1-	<0.4 ug/L	116	60-130
Dichloroethylene, 1,1-	<0.5 ug/L	116	60-130
Dichlorobenzene, 1,2-	<0.4 ug/L	103	60-130
Dichloroethane, 1,2-	<0.2 ug/L	113	60-130
Dichloropropane, 1,2-	<0.5 ug/L	105	60-130
1,3,5-trimethylbenzene	<0.3 ug/L	118	60-130
Dichlorobenzene, 1,3-	<0.4 ug/L	108	60-130
Dichlorobenzene, 1,4-	<0.4 ug/L	101	60-130
Benzene	<0.5 ug/L	109	60-130

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Bromodichloromethane	<0.3 ug/L	105	60-130
Bromoform	<0.4 ug/L	91	60-130
Bromomethane	<0.5 ug/L	118	60-130
Dichloroethylene, 1,2-cis-	<0.4 ug/L	101	60-130
Dichloropropene,1,3-cis-	<0.2 ug/L	104	60-130
Carbon Tetrachloride	<0.2 ug/L	117	60-130
Chloroethane	<0.2 ug/L	112	60-130
Chloroform	<0.5 ug/L	112	60-130
Dibromochloromethane	<0.3 ug/L	106	60-130
Dichlorodifluoromethane	<0.5 ug/L	106	60-130
Methylene Chloride	<4.0 ug/L	85	60-130
Ethylbenzene	<0.5 ug/L	110	60-130
Ethylene dibromide	<0.2 ug/L	100	60-130
Hexane (n)	<5 ug/L	120	60-130
m/p-xylene	<0.4 ug/L	112	60-130
Chlorobenzene	<0.2 ug/L	111	60-130
o-xylene	<0.4 ug/L	112	60-130

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Styrene	<0.5 ug/L	97	60-130
Dichloroethylene, 1,2-trans-	<0.4 ug/L	105	60-130
Dichloropropene,1,3-trans-	<0.2 ug/L	103	60-130
Tetrachloroethylene	<0.3 ug/L	120	60-130
Toluene	<0.5 ug/L	112	60-130
Trichloroethylene	<0.3 ug/L	91	60-130
Trichlorofluoromethane	<0.5 ug/L	104	60-130
Vinyl Chloride	<0.2 ug/L	104	60-130
Run No 332977 **Analysis/Extraction Date** 2017-09-11 **Analyst** TJB			
Method V 8260B			
Xylene Mixture			
Run No 332986 **Analysis/Extraction Date** 2017-09-11 **Analyst** C F			
Method C SM4500-CNC			
Cyanide (CN-)	<5 ug/L	112	75-125
Run No 333003 **Analysis/Extraction Date** 2017-09-11 **Analyst** SKH			
Method M SM3120B-3500C			
Sodium	<2000 ug/L	101	82-118
Run No 333010 **Analysis/Extraction Date** 2017-09-11 **Analyst** AJS			

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Method M SM3112B-3500B			
Mercury	<0.0001 ug/L	100	76-123
Run No 333047 **Analysis/Extraction Date** 2017-09-11 **Analyst** JLD			
Method P 8270			
1+2-methylnaphthalene	<0.1 ug/L		
Run No 333054 **Analysis/Extraction Date** 2017-09-11 **Analyst** JLD			
Method P 8270			
Methlynaphthalene, 1-	<0.1 ug/L	60	50-140
Methlynaphthalene, 2-	<0.1 ug/L	60	50-140
Acenaphthene	<0.1 ug/L	56	50-140
Acenaphthylene	<0.1 ug/L	54	50-140
Anthracene	<0.1 ug/L	62	50-140
Benz[a]anthracene	<0.1 ug/L	70	50-140
Benzo[a]pyrene	<0.01 ug/L	69	50-140
Benzo[b]fluoranthene	<0.05 ug/L	72	50-140
Benzo[ghi]perylene	<0.1 ug/L	58	50-140
Benzo[k]fluoranthene	<0.05 ug/L	76	50-140
Chrysene	<0.05 ug/L	68	50-140

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Dibenz[a h]anthracene	<0.1 ug/L	62	50-140
Fluoranthene	<0.1 ug/L	64	50-140
Fluorene	<0.1 ug/L	60	50-140
Indeno[1 2 3-cd]pyrene	<0.1 ug/L	64	50-140
Naphthalene	<0.1 ug/L	52	50-140
Phenanthrene	<0.1 ug/L	64	50-140
Pyrene	<0.1 ug/L	64	50-140
Run No 333087 **Analysis/Extraction Date** 2017-09-12 **Analyst** AET			
Method SUBCONTRACT P-INORG			
Chromium VI	<10.0 ug/L	92	80-120
Run No 333140 **Analysis/Extraction Date** 2017-09-13 **Analyst** H F			
Method SM 4110			
Chloride	<1000 ug/L	97	90-110

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: EnGlobe Corp. (Toronto)
1821 Albion Road, Unit 7
Toronto, ON
M9W 5W8
Attention: Mr. Nan Du
PO#: A10832
Invoice to: EnGlobe Corp.

Report Number: 1717130
Date Submitted: 2017-09-07
Date Reported: 2017-09-13
Project: B-0017786
COC #: 192520

Sample Comment Summary

Sample ID: 1319057 BH/MW-6 Metals spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte. Metals duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the MRL. Sodium analysis for this report performed from nitric acid preserved bottle.

Guideline = O.Reg 153-T1-Groundwater *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Appendix 5 Multi-Channel Analysis of Surface Waves (MASW) Report

GEOPHYSICS GPR INTERNATIONAL INC.
6741 Columbus Road
Unit 14
Mississauga, Ontario
Canada L5T 2G9
Tel.: (905) 696-0656
Fax: (905) 696-0570
gprtor@gprtor.com
www.geophysicsgpr.com

October 4th, 2019 GPR file: T191597

Jason Boland, PMP
Engineering and Technical Support Coop Student
Fisheries and Oceans Canada/ Government of Canada
520 Exmouth St.
Sarnia, ON
N7T 8B1

RE: Shear-wave velocity sounding at Port Weller, 4 Welland Canals Parkway, St. Catharines, Ontario

Dear Mr. Boland,

Geophysics GPR International Inc. has been requested by the Fisheries and Oceans /Government of Canada to carry out a shear-wave velocity sounding at the above site in St. Catharines. Figure 1 shows the location of the test profile.

The survey was performed on August 6th, 2019.

The investigation included the multi-channel analysis of surface waves (MASW), the micro-tremor array measurements (MAM) and the refraction methods to generate a shear-wave velocity model (Figure 4).

The following paragraphs describe the survey design, the principles of the test method, the methodology for interpreting the data, and provide a culmination of the results in table format.

Figure 1: Approximate location of the shear-wave velocity sounding

MASW and MAM Surveys

Basic Theory

The Multi-channel Analysis of Surface Waves (MASW) and the Micro-tremor Array Measurements (MAM) are seismic methods used to evaluate the shear-wave velocities of subsurface materials through the analysis of the dispersion properties of Rayleigh surface waves ("ground roll"). The dispersion properties are measured as a change in phase velocity with frequency. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. Inversion of the Rayleigh wave dispersion curve yields a shear-wave (V_s) velocity depth profile (sounding). Figure 2 outlines the basic operating procedure for the MASW method. Figure 3 is an example image of a typical MASW record and resulting 1D V_s model. A more detailed description of the method can be found in the paper *Multi-channel Analysis of Surface Waves,* Park, C.B., Miller, R.D. and Xia, J. Geophysics, Vol. 64, No. 3 (May-June 1999); P. 800–808.

Survey Design

The geometry of an MASW survey is similar to that of a seismic refraction investigation (i.e. 24 geophones in a linear array). The fundamental principle involves intentionally generating an acoustic wave at the surface and digitally recording the surface waves from the moment of source impact with a linear series of geophones on the surface. This is referred to as an "active source" method. An elastic-wave hammer was used as the primary energy source with traces being recorded at 6 locations: approximately 6 m off both ends, 25 to 30 m off both ends, and in the middle of the spread. Data were collected with geophones

spacing of 3m and 1m for a total of 10 shot records per sounding.

Unlike the refraction method, which produces a data point beneath each geophone, the shear-wave depth profile is the average of the bulk area within the middle third of the geophone spread.

The theoretical maximum depth of penetration (34.5m) is half of the maximum seismic array length (69 m), in practice the maximum depth of penetration is often influenced by the geology.

The MAM/passive survey used the same geophone array set up as for the MASW survey. Unlike the MASW survey, the MAM method is considered a "passive source" method in that there is no time break and the motions recorded are from ambient energy generated by cultural noise such as traffic, wind, wave motion, etc. Data collection for the passive method involves recording approximately 10 minutes of background "noise." The records generated by the MAM method contain lower frequency data, thus increasing the data resolution at greater depths of investigation. Typically the MAM results aid in clarifying the MASW results for depths greater than 20 m; however, the direction of noise propagation relative to the spread orientation can influence the results.

Interpretation Method and Accuracy of Results

The main processing sequence involved plotting, picking, and 1-D inversion of the MASW/MAM shot records using the SeisimagerSW™ software package. In theory, all MASW shot records should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation and localized surface variations. The results of the inversion process are inherently non-unique and the final model must be judged to be geologically realistic. The inversion modelling also assumes that all layering is flat/horizontal and laterally uniform.

The results of the MASW/MAM tests are presented in chart format as Figure 4. The chart presents the 1-D shear wave velocity values from the inversion models of the passive and active seismic records.

The V_s30 values for the sounding are presented in Table 1. The V_s30 values are based on the harmonic mean of the shear wave velocities over the upper 30 m. The V_s30 value is calculated by dividing the total depth of interest (e.g. 30 m) by the sum of the time spent in each velocity layer up to that depth. This harmonic mean value reflects the equivalent single layer response.

The estimated error in the average V_s30 value determined through MASW tests is typically +/-10 to 15% for overburden sites. The shear-wave velocities modelled through the MASW method within bedrock have a higher estimated error.

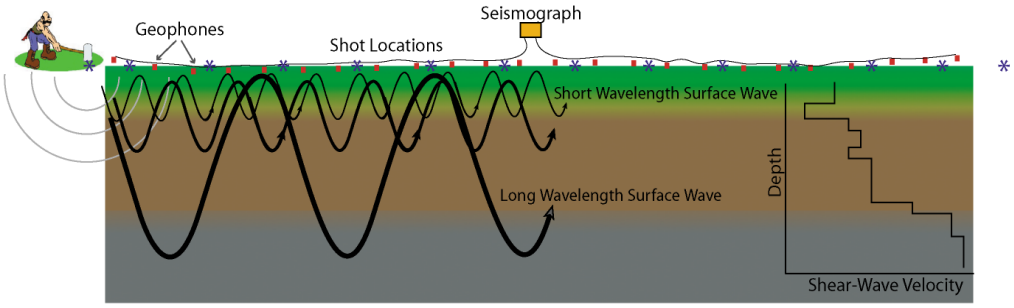
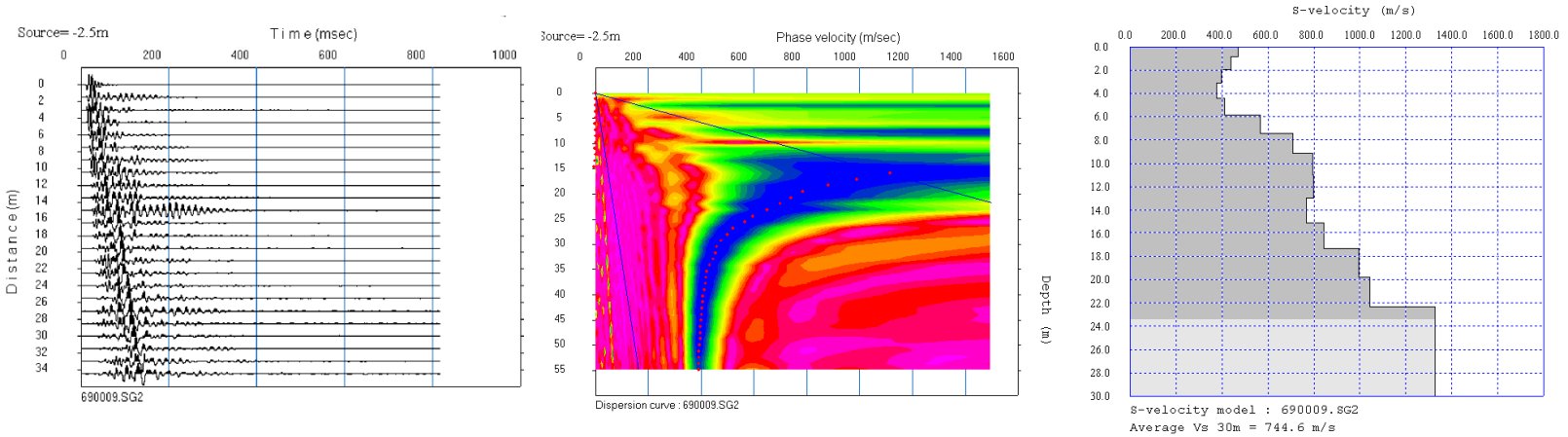


Figure 2: MASW Operating Principle



Raw Seismic Shot Record

Phase Velocity-Frequency Transformation indicating Dispersion Curve

1D Shear-Wave Velocity Profile from Inversion of Dispersion Curve

Figure 3: Example of a typical MASW shot record, phase velocity/frequency curve and resulting 1D shear-wave velocity model.

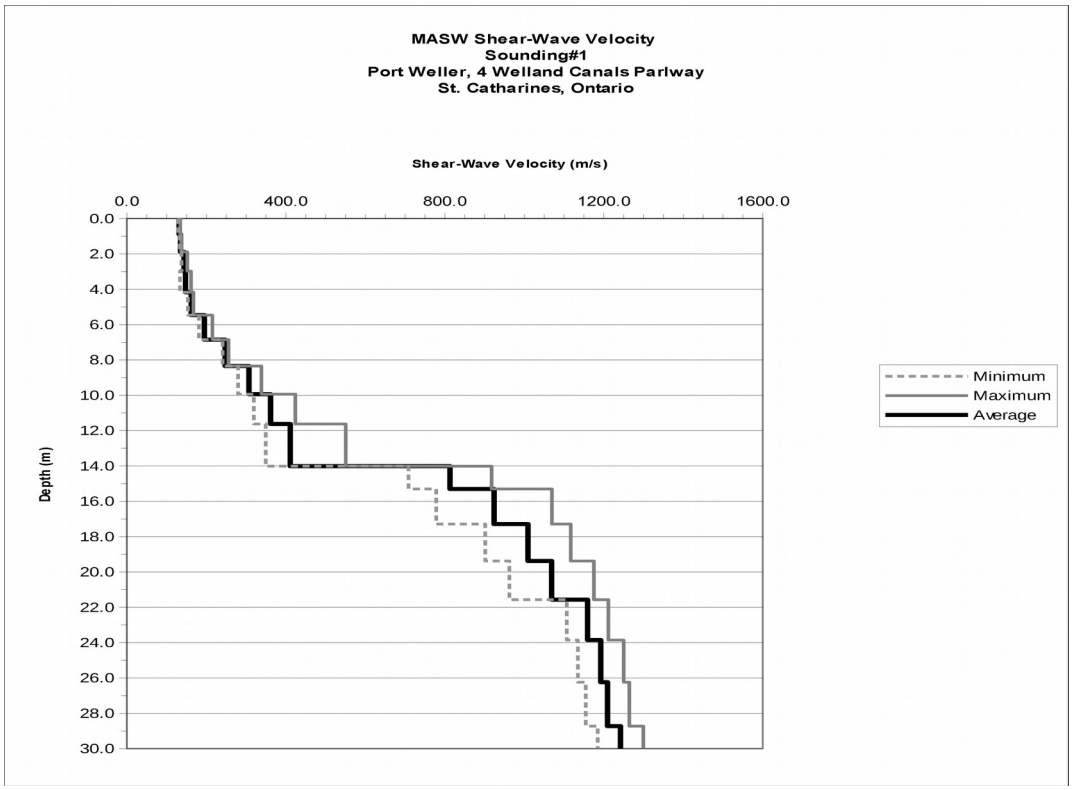


Figure 4: MASW Shear-wave Velocity Sounding

CONCLUSIONS

The approximate location of the shear-wave sounding is indicated in Figure 1.

The MASW shear-wave models are presented in Figure 4. The results are summarized in Table 1. The background seismic noise levels at this site were moderate. The quality of the seismic records and the resulting dispersion was good.

Simple critical distance calculations from the refracted wave arrivals show that the water table could be approximately 5m deep. A shale bedrock could be approximately 14m deep.

A geotechnical report was provided by the client containing six boreholes from 2.1 to 6.7 mbgs.

Table 1: Calculated V_s30 values (m/s) from the MASW data (0 to 30m)

Sounding	Minimum	Average	Maximum	Site Class
1	342	**368**	399	**D***

* Given the estimate error of 10%

The calculated average V_s30 values from the 1D MASW soundings collected was 368m/s +/-15% to 20%.

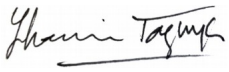
The V_s30 values calculated for the minimum and the maximum envelopes ranged from 342 to 399m/s.

Based on the average V_s30 values (as determined through the MASW method) and table 4.1.8.4.A of the National Building Code of Canada, 2015 Edition, the investigated area is site class "D" ($180 < V_S30 \leq 360$ m/s).

More accurate seismic data using a downhole technique could help achieving class "C" for this site if required. This will need a prepared hole.

It must be noted that the site classification provided in this report is based solely on the V_s30 value as derived from the MASW method and that it can be superseded by other geotechnical information including high plasticity index (PI> 20), moisture content ($w \geq 40\%$) and undrained shear strength ($s_u < 25$ kPa). Additionally, the Vs30 based site class can be superseded by the presence of peat and/or highly organic clays greater than 3m in thickness. Based on the geotechnical report prepared by Englobe the plasticity index and moisture content are not within the range that would supersede the site class based on shear-wave velocity nor is peat or sensitive clays noted. The reader is referred to Englobe report and section 4.1.8.4 of the National Building Code of Canada, 2015 Edition for the full details and more information on the requirements for site classification.

This report has been written by Lhoucin Taghya, P.Geo.



Lhoucin Taghya, P.Geo.
Geophysicist

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Hazardous Building Materials Assessment
Fisheries and Oceans Canada
Port Weller
St. Catharines, Ontario

u 

Prepared for:
Fisheries and Oceans Canada
501 University Crescent
Winnipeg, Manitoba R3T 2N6

Attention: Duane Jordan, CET
Project Manager

Pinchin File: 92340

April 3, 2014

EXECUTIVE SUMMARY

Pinchin Environmental Ltd. (Pinchin) was retained by Fisheries and Oceans Canada (Client) to conduct an assessment of hazardous building materials in the two building located at Port Weller in St. Catharines, Ontario. The entirety of both buildings was assessed.

Summary of Findings

Hazardous materials were confirmed to be present as follows:

Asbestos

- Exterior caulking

Lead

- Lead-containing paint
- Lead in wiring connectors, grounding conductors and solder
- Lead-acid batteries in back-up emergency lighting

Mercury

- Mercury in fluorescent lamps

Polychlorinated Biphenyls

- PCBs may be present in light ballasts

Silica

- Silica in concrete, mortar, brick, masonry, and ceramics

Mould

- Visible mould is present on drywall and concrete in limited areas

Summary of Recommendations

Asbestos-containing materials (ACM) that may be disturbed during the project must be removed prior to any renovation, demolition etc.

Refer to recommendations section for procedures required when disturbing or removing hazardous building materials.

No remedial asbestos work is required. Complete the lead remedial work listed in Item 4.3 and the mould remedial work listed in Item 4.7.

TABLE OF CONTENTS

1.0 INTRODUCTION AND SCOPE

1.1 Introduction

Pinchin Environmental Ltd. (Pinchin) was retained by Fisheries and Oceans Canada (DFO, Client) to conduct an assessment of hazardous building materials in the two buildings located at Port Weller in St. Catharines, Ontario.

This report was prepared to fulfil the Owner's requirements under Section 30 of the Ontario Occupational Health and Safety Act, Revised Statutes of Ontario 1990, (as amended). Prior to tendering project work in the building, the building owner or owner's agent must provide this report to constructors bidding on the project work. In turn, the constructor must provide this report to contractors and subcontractors prior to requesting bids. This report also fulfills the requirements of Section 10 of O.Reg. 278/05, Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations. This requires that owners report the presence of both friable and non-friable asbestos to constructors as part of the tendering process or prior to arranging for work.

The assessment was performed as a prerequisite to planned demolition. This assessment is intended for pre-construction or pre-demolition purposes only, and may not provide sufficient detail for long term management of asbestos-containing materials (ACM) as required in Section 8 (3) of O.Reg. 278/05.

The assessment was performed by Ms. Leslie Cantar and Mr. Chris Mego of Pinchin on March 17, 2014. The surveyors were accompanied by Mr. Dave McGinnis of Fisheries and Oceans Canada during the assessment.

1.2 Facility Description

The Galley House was constructed in the 1930's, and consists of one storey with an area of approximately 1,000 square feet. The Office House was constructed in the 1950's and consists of one storey plus a basement and has an area of approximately 1,000 square feet. The houses are connected by a Garage/Work Shop area with an area of approximately 500 square feet. The following provides a basic description of the building systems.

System	Description
Structure	Structural steel, wood, and concrete
Exterior Cladding	Plaster, concrete, and aluminum siding
HVAC	Furnaces with forced air heating and radiant heaters.

System	Description
Roof	Sloped shingled roof and modified bitumen flat roof
Flooring	Vinyl tile, ceramic tile, concrete, carpet, and vinyl sheet flooring
Interior Walls	Drywall, wood, concrete, and plaster
Ceilings	Drywall, wood, acoustic ceiling tiles, and plaster

1.3 Scope of Assessment

The entirety of both building was assessed. The assessment was performed to establish the location and type of hazardous building materials incorporated in the structures and their finishes. For the purpose of the assessment, and this report, hazardous building materials are defined as those containing the following substances:

The following Ontario Ministry of Labour Designated Substances:

- Asbestos
- Lead
- Mercury
- Silica (free crystalline silica)

The investigation included an examination for the presence of:

- Polychlorinated Biphenyls (PCBs)
- Mould or microbial contamination (visible growth only)

The following Designated Substances are not typically found in building materials in a composition/state that is hazardous. Therefore, these materials were not addressed in this assessment. Furthermore, the Client did not report the use of any of the following Designated Substances in processes:

- Arsenic
- Acrylonitrile
- Benzene
- Coke oven emissions
- Ethylene oxide
- Isocyanates
- Vinyl chloride (vinyl chloride monomer, not PVC)

Owner or occupant processes, articles within the building(s) such as stored items, furniture, etc., subsurface materials or equipment (vessels, drums, underground storage tanks, pipes, etc.),

possible contaminants in the soil and groundwater on the site, and sampling of materials that could result in a hazard to the surveyor or damage to the building were not included in the assessment.

2.0 ASSESSMENT METHODOLOGIES AND CRITERIA

2.1 Methodology

The surveyor entered each room, corridor, service area, etc. where access was possible within the extent of the assessed area and inspected for the presence of hazardous building materials. Relevant information was recorded where hazardous building materials were observed, including approximate quantities, locations, condition, sample information and sample locations. Quantities reported are an approximate visual estimate.

Concealed locations such as spaces above solid ceilings, shafts and pipe chases were accessed via existing access panels. Limited destructive testing to view under carpet was performed, where possible. Structural items or exterior building finishes were not removed to determine the presence of concealed materials. Wall spaces and concealed chases (e.g. at washrooms) were not demolished or accessed during this assessment.

2.2 Asbestos

The surveyor inspected for the presence of friable and non-friable ACM. Typical examples of friable ACM include sprayed fireproofing, acoustic/texture finish, and mechanical insulation. Typical examples of non-friable ACM include asbestos cement sheets or pipes, vinyl floor tiles, vinyl sheet flooring, drywall compound and asbestos textile products. Typical examples of non-friable ACM, which have the potential to become friable during construction, include plaster and acoustic ceiling tiles. Refer to Appendix I for a definition of friability.

2.2.1 Asbestos Sampling Exclusions

A number of materials which might contain asbestos were *not* sampled during our assessment for various reasons. Reasons for not sampling these materials include;

- Sampling the material may be hazardous to the surveyor (e.g. electrical hazard);
- Sampling the materials may cause consequential damage to the property (e.g. sampling roofing may cause leaks);
- The material is inaccessible without major demolition (e.g. inside boilers etc.) or;
- The material is present in such an inconsistent fashion that without complete removal of finishes, the extent of ACM cannot be determined (e.g. floor levelling compound).

If present, these materials must be presumed to be asbestos-containing and are best sampled *immediately* prior to commencing renovation (see list of presumed ACM in Findings Section).

2.2.2 Asbestos Sampling Strategy and Frequency

Asbestos bulk samples were collected at a rate that was in compliance with the requirements of O.Reg. 278/05. The Regulation identifies the minimum number of samples to be collected and analyzed (1, 3, 5, or 7 depending on quantity, application and friability) from each homogeneous material, in order for the material to be considered non-asbestos. This frequency is indicated in Table 1 of the Regulation (see Appendix I). A homogeneous material is defined in Regulation 278/05 as one that is uniform in colour and texture. The surveyor used information obtained on site by visual examination, available information on the phases of the construction and any information on renovations provided by the client, to determine the extent of each homogeneous area and the number of samples required.

The use of asbestos in drywall joint compound was banned in Canada under the Federal Hazardous Products Act of 1980 but it could possibly contain asbestos as late as 1986 (due to stored material and non-compliance with the ban). Most buildings undergo constant renovation, including the removal and replacement of drywall partitions. Attempts to distinguish and delineate asbestos-containing drywall compound from new non-asbestos drywall compound is often unachievable. Therefore, drywall joint compound was sampled at exterior walls, columns or other locations which are unlikely to have been renovated in an attempt to determine the presence of asbestos in the original drywall compound.

Asbestos cement products and various other non-friable materials (e.g. vibration dampers) were visually identified as ACM where present and where visual identification is reliable.

Ontario was the first Canadian Province to ban the use of friable asbestos (March 1986, O.Reg. 654/85). Of the many non-friable materials, only drywall joint compound has been banned in Canada. Therefore in theory, all other non-friable materials and surfaces in which asbestos could have been used, should be sampled for total certainty that it is non-asbestos, even to the present day. In practice however, asbestos ceased being used in most materials by manufacturers as a result of asbestos concerns. Pinchin is aware of many of the dates that certain materials ceased being manufactured with asbestos. Based on this knowledge, we suggest that sampling of certain materials is not required after specific dates and our sampling strategy was based on this knowledge. In addition, to be conservative we allow several years past these dates in our strategy. This allows additional time so that stored ACM products would have worked through the supply chain, and allows for some uncertainty in the exact start/finish date of construction and associated usage of ACM. We believe this is a prudent and responsible limitation and that the sampling strategy is appropriate.

Exterior caulking was sampled at the client's request. Locations of caulking sampling were not repaired. Pinchin is not responsible or liable for leaks or water damage caused by sampling/repair.

2.2.3 Basis of Evaluation and Recommendations regarding ACM

The condition and the potential for disturbance of any ACM observed were evaluated. The evaluation criteria were based on the conclusions of published studies, particularly the "Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario", existing Ontario regulation, and our experience involving buildings that contain ACM.

An ACM was considered damaged if it is sprayed material that is delaminating, mechanical insulation with damaged/missing insulation or jacketing, or non-friable materials that have been pulverized or damaged so that they have become friable.

The priority for remedial action is based not only on the evaluation of condition but is also based on several other factors which include:

- Accessibility or potential for direct contact and disturbance.
- Practicality of repair (for example, will damage to the ACM continue even if it is repaired).
- Visibility of the material.
- Efficiency of the work (for example, if damaged ACM is being removed in an area, it may be most practical to remove all ACM in the area even if it is in good condition).

Recommendations also include removal of ACM that may be disturbed by any planned renovation or demolition activity known to Pinchin.

2.3 Lead

Each distinctive paint finish present in more than very limited application was sampled for lead content. Paint samples were collected and submitted to a laboratory for analysis. Locations at which lead paint samples are collected were recorded on small scale plans.

The Ontario Ministry of Labour (MOL) has not established a lower limit for concentrations of lead in paint, below which precautions do not need to be considered. The MOL will not accept U.S. Environmental Protection Agency (EPA) or U.S. Housing and Urban Development (HUD) limits (greater than 0.5%, or 1 mg/cm^2) for lead for this purpose. For this report, all paints containing lead at a concentration greater than the RDL (Reliable Detection Limit) for the test method have been discussed.

Building materials suspected of containing lead (e.g. lead sheeting) were identified by appearance and age, and knowledge of historic applications.

2.4 Mercury

Building materials suspected of containing mercury were identified by appearance, age, and knowledge of historic applications. Sampling was not performed. Dismantling of equipment suspected of containing mercury was not performed.

2.5 Silica

Building materials suspected of containing crystalline silica were identified by knowledge of current and historic applications. Sampling was not performed.

2.6 Polychlorinated Biphenyls (PCBs)

Information labels on electrical equipment such as transformers and capacitors for motors were examined where available to determine PCB content. The information was compared against information available in the "Handbook on PCB's in Electrical Equipment" issued by Environment Canada, in order to determine PCB content of materials. Bulk sampling was not performed at live cables, or of dielectric fluids or materials in transformers or capacitors.

Light ballasts are present in fluorescent and HID light fixtures. Fluorescent light fixtures were not disassembled to examine ballasts during this assessment. It is assumed in a building of this era, that some of the light ballasts will contain PCB's if the building has not been re-lamped and all ballast replaced.

Exterior caulking and sealants were analyzed for PCB content.

This assessment is intended for pre-construction or pre-demolition purposes only, and may not provide sufficient detail for long term management of PCBs or to determine end-of-use inventories as required in SOR/2008-273.

2.7 Visible Mould

Mould was identified if visibly present in a significant quantity on exposed building surfaces. If any mould growth is concealed within wall cavities it was not addressed in this assessment.

A limited number of bulk samples were collected where necessary to confirm the presence of any suspected visible mould growth.

2.8 Analytical Methods

2.8.1 Asbestos

Bulk samples collected for asbestos identification were analyzed at Scientific Analytical Institute (SAI). Preliminary identification of asbestos fibres was made using polarized light microscopy, with confirmation of the presence and type of asbestos by dispersion staining optical microscopy. The analysis was performed in accordance with Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, July 1993. SAI is certified under the National Voluntary Laboratory Accreditation Program (NVLAP) to perform asbestos analysis of bulk samples.

The asbestos analysis was completed using a stop positive approach. Only one result of greater than 0.5% asbestos content is required to determine that a material is asbestos-containing, but all samples must be analyzed to conclusively determine that a material is non-asbestos (O. Reg. 278/05). The laboratory stopped analyzing samples from a homogeneous material once greater than 0.5% asbestos was detected in any of the samples of that material. All samples of a homogeneous material were analyzed if no asbestos was detected. Where building materials are described in this report as non-asbestos, or described as containing no asbestos, this is subject to the limitations of the analytical method used, and should be understood to mean no asbestos was detected.

Analytical results are presented in Appendix II.

2.8.2 Lead

The bulk analysis for lead was performed by EPA Method No. 3050B/Method No. 7420; Flame Atomic Absorption at Scientific Analytical Institute (SAI). SAI is accredited by the American Industrial Hygiene Association (AIHA).

Analytical results are presented in Appendix III.

2.8.3 Polychlorinated Biphenyls (PCBs)

PCB samples were analyzed at Aevitas Inc. using the analytical method appropriate to the material matrix. Aevitas Laboratories are accredited by CALA.

Analytical results are presented in Appendix VI.

2.8.4 Mould

Mould samples were analyzed at the Pinchin Microbiology Laboratory, Mississauga, Ontario. The Pinchin laboratory is accredited for culture and direct microscope fungal analysis by the AIHA Environmental Microbiology Laboratory Accreditation Program. The Pinchin laboratory also participates in the AIHA Environmental Microbiology Proficiency Analytical Testing Program.

Analytical results are presented in Appendix VI.

2.9 Photographs

Photographs are presented in Appendix IV.

2.10 Drawings

Included on the drawings in Appendix V, are locations where samples were collected. Drawings also show the approximate locations of asbestos-containing caulking and mould growth.

3.0 FINDINGS

3.1 Asbestos

3.1.1 Sprayed Fireproofing and Thermal Insulation

Sprayed fireproofing or sprayed thermal insulation was not found.

3.1.2 Texture Finishes (Acoustic/Decorative)

Texture finishes were not found.

3.1.3 Pipe Insulation

Pipes are either uninsulated or insulated with non-asbestos foam or armaflex insulation. Refer to photograph 1 in Appendix IV.

3.1.4 Duct Insulation

Ducts are either uninsulated or insulated with non-asbestos fibreglass and jacketed with foil. Refer to photograph 2 in Appendix IV.

3.1.5 Mechanical Equipment Insulation

All mechanical equipment is insulated with non-asbestos fibreglass or not insulated. Refer to photograph 3 in Appendix IV.

3.1.6 Acoustic Ceiling Tiles

One visually distinct type of acoustic ceiling tile was identified in the buildings and determined to be non-asbestos based on the nature of the material (fibreglass). Refer to photograph 4 in Appendix IV.

3.1.7 Vermiculite

Loose fill vermiculite was not found. The attic was inspected above solid ceilings, and concrete block walls were not observed.

3.1.8 Plaster

Smooth plaster is present on walls and ceilings in the Office House. Five samples of plaster were collected (samples 0002A-E). No asbestos was detected in the plaster.

Non-asbestos rough plaster is present as an exterior finish on the Office House and connecting Garage (samples 0005A-C). Refer to photograph 5 in Appendix IV.

3.1.9 Drywall Compound

The use of asbestos in drywall joint compound was banned under the Federal Hazardous Products Act of 1980 but it could possibly contain asbestos as late as 1986 (due to stored material and non-compliance with the ban). Most buildings undergo constant renovation, including the removal and replacement of drywall partitions. Attempts to distinguish and delineate asbestos-containing drywall compound from new non-asbestos drywall compound is often unachievable. Therefore, drywall joint compound was sampled at exterior walls, columns or other locations which are unlikely to have been renovated in an attempt to determine the presence of asbestos in the original drywall compound.

Drywall (gypsum board) is present as a wall and ceiling finish throughout the Galley House. Three samples of drywall joint compound were collected (samples 0001A-C). Asbestos was not detected in the joint compound.

3.1.10 Asbestos Cement Products (Transite)

No asbestos cement products were found.

3.1.11 Vinyl Sheet Flooring

One visually distinct type of vinyl sheet flooring is present in the buildings, as follows:

Pattern	Colour	Paper Backing?	Locations	Sample Number	Asbestos Type in Paper Backing
None	Grey/tan	Yes	Below carpets in the Supernumerary Cabin and Entranceway of the Office House	0003A-C	None Detected

Refer to photograph 6 in Appendix IV.

3.1.12 Vinyl Floor Tile and Mastic

One visually distinct type of vinyl floor tile is present in the buildings, as follows:

Tile Size (inches)	Colour	Locations (Quantity in Square Feet)	Sample Numbers	Asbestos Type - Vinyl Floor Tile	Asbestos Type - Mastic
12” x 12”	Brown flecks	Basement of Office House	Install Date 1999	None	None

Refer to photograph 7 in Appendix IV.

3.1.13 Sealants – Caulking, Putty and Black Tar Based Mastics

White caulking, containing chrysotile asbestos, is present at exterior window frames of both buildings (sample 0004A). Caulking is non-friable and is in good condition (approximately 500 linear feet). Refer to photograph 8 in Appendix IV.

Grey caulking, containing chrysotile asbestos, is present at exterior window frames of both buildings (sample 0006A) and at the base of exterior walls of the Galley House and connecting Garage. Caulking is non-friable and is in good condition (approximately 700 linear feet). Refer to photograph 9 in Appendix IV.

Non-asbestos black caulking is present on parapets on the roof of the Galley House (samples 0008A-C). Refer to photograph 10 in Appendix IV.

Interior caulking was not found at window or door frames. Non-asbestos silicone caulking is present within window frames at window panes. Refer to photograph 11 in Appendix IV.

Non-asbestos tar paper is present at the wall connection between the Garage and the Office House (samples 0007A-C).

3.1.14 Roofing

Roofing materials were determined to be non-asbestos based on the nature of the materials (shingles and modified bitumen flat roof) and the date of installation of the modified bitumen roof (approximately 10 years ago). Refer to photograph 12 in Appendix IV.

3.2 Presumed Asbestos-Containing Materials

A number of materials which might contain asbestos were *not* sampled during our assessment. If present, these materials must be presumed to be asbestos-containing and are best sampled *immediately* prior to commencing renovation or demolition. Materials[1] presumed to contain asbestos include;

- components or wiring within motor control centers, breakers, motors or lights
- insulation on or in high voltage wiring
- mechanical packing, ropes and gaskets

3.3 Lead

3.3.1 Lead-Containing Paint and Coatings

Appendix III presents the lead bulk sample analytical results.

Lead-containing paint was sampled in the following areas on the following items:

[1] Materials are non-friable except where noted.

Sample Name	Room/Location	Component or Substrate	Colour	Lead Content (% by weight)
L001	Cabin #2, Galley House	Drywall wall	White	0.52
L002	Breaker Closet, Galley House	Concrete wall	Beige	15%
L003	Connecting Garage/Work Shop	Concrete floor	Grey	0.48
L004	Basement, Office House	Plywood wall	White	0.095
L006	Exterior, Galley House	Concrete wall	Blue-grey	0.14
L007	Exterior, Galley House	Concrete wall	Grey	16
L008	Exterior, Galley House	Wood door frame	White	Presumed lead
L009	Exterior, Galley House	Concrete window sill	Black	3.7

Lead-containing paint was flaking/peeling in the following areas;

- All exterior paint on Galley House (approximately 200 square feet).

Results of the remaining paint sampled were below the detection limit (sample L005).

Refer to photograph 13 in Appendix IV.

3.3.2 Other Lead Applications

Lead is present in wiring connectors, grounding conductors and solder throughout the building.

Back-up emergency lights, present throughout the building, are powered with lead-acid batteries.

3.4 Mercury

Mercury vapour is present in all fluorescent lamps (approximately 70 present throughout the buildings).

3.5 Silica

Free crystalline silica (common construction sand) is present in concrete, ceramics, etc., where present in the buildings.

3.6 Polychlorinated Biphenyls (PCBs)

All transformers in the building are dry type transformers and do not contain PCB-containing dielectric fluids.

The buildings have not been comprehensively re-lamped with new energy efficient light ballasts and lamps, and as such, a percentage of light ballasts will be pre-1978 and contain PCB’s.

PCB impregnated cables and other electrical equipment were not sampled.

Three types of exterior caulking were sampled. All contained a level of PCBs less than the detection limit; <0.5 mg/kg of PCBs (samples P001 to P003). Materials containing less than 50 mg/kg are considered non-PCB containing for disposal.

3.7 Visible Mould

Visible mould growth was observed on water damaged drywall present at the exterior entrance to the Generator Room in the Galley House (approximately 4 square feet). Mould growth was confirmed by bulk sampling (sample B-001). Refer to photograph 14 in Appendix IV.

Visible mould growth was observed on painted concrete walls within the Breaker Closet in the Galley House (approximately 8 square feet). Mould growth was confirmed by bulk sampling (sample B-002). Refer to photograph 15 in Appendix IV.

4.0 RECOMMENDATIONS

4.1 General

This report must be given to the constructor. In turn the constructor must provide this report to contractors and sub-contractors.

Constructors/Contractors must use the information in this report when filing a Notice of Project Form with the Ontario Ministry of Labour. In Section 6 of the form, check all Designated Substances listed in this report that will be disturbed.

Dispose of waste containing hazardous materials as per the requirements of applicable waste handling regulations[2].

4.2 Asbestos

4.2.1 Remedial Work

Asbestos remedial work is not required.

4.2.2 Renovation Work

We recommend from practical experience that ACM be removed if it may be disturbed by maintenance, construction or demolition activities. Pinchin has identified the following ACM that may be disturbed during the work and should be removed prior to disturbance.

[2] Transportation and disposal of Hazardous Building Materials are under the jurisdiction of Federal, Provincial and local government agencies. Primarily, Ministry of the Environment Regulation 347 as amended dictates disposal requirements. However, regional dumpsites have the ability to impose more stringent requirements. Disposal of some Hazardous Building Materials may require testing prior to disposal so as to classify the waste.

Material	Location	Recommended Abatement Procedure
Asbestos-containing white window caulking	Exterior	Removal and disposal following Type 1 procedures
Asbestos-containing grey caulking	Exterior	Removal and disposal following Type 1 procedures

If the identified ACM will not be removed prior to commencement of the work, disturbance of ACM must follow the appropriate asbestos precautions for the classification of work being performed (see headings below for general procedures):

Sample all materials excluded from sampling or presumed to contain asbestos immediately prior to removal where required.

4.2.3 Building Demolition

Prior to building demolition, all ACM must be removed.

Sample all materials excluded from sampling or presumed to contain asbestos immediately prior to removal where required.

4.2.4 Sealants – Caulking, Putty and Tar

If the caulking must be removed as a result of planned demolition, renovation, etc, use Type 1 procedures as outlined within Ontario Regulation 278/05 if the work is done using wet methods and using hand-held non-powered tools.

4.3 Lead

Construction disturbance of lead-containing products may result in exposure to lead. Cutting, grinding, drilling, removing, stripping or demolition of materials containing or coated with lead should be completed only with proper respiratory protection and other worker safety precautions as outlined in the Ministry of Labour Guideline – Lead on Construction Projects, 2004. The Ministry has not established a lower limit for concentrations of lead in paint (or other materials) below which precautions do not need to be considered, and will not accept US EPA or HUD limits (0.5% lead) for this purpose. Therefore the need for precautions and details of worker safety will need to be assessed on a project by project basis. Pinchin recommends that the building owner and contractor seek advice to develop a site-specific safety plan (including air monitoring) that considers the various factors that would affect worker exposure to lead from paint and other materials. Performing an exposure assessment during work that disturbs lead-containing coatings may be able to alleviate the use of some of the precautions that are required.

4.3.1 Remedial Recommendations

The building owner and/or contractor should develop site specific procedures for the Ministry of Labour designated lead operations. These lead operations and precautions are outlined in the Ministry of Labour Guideline Lead on Construction Projects, 2004.

The flaking lead-containing paint on the exterior of the Galley House (approximately 200 SF) should be removed using one of the following:

Type 1 Lead Operations

- Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap.

OR

Type 2A Lead Operations

- Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools.

4.4 Mercury

Do not break lamps or separate liquid mercury from components. Mercury-containing materials and lamps should be recycled to reclaim the mercury. Disposal in significant quantities would require mercury-containing materials to be disposed of as hazardous waste.

4.5 Silica

Construction disturbance of silica-containing products may result in excessive exposures to airborne silica, especially if performed indoors and dry. Cutting, grinding, drilling or demolition of materials containing silica should be completed only with proper respiratory protection and other worker safety precautions as outlined in the Ministry of Labour Guideline – Silica on Construction Projects, 2004.

4.6 Polychlorinated Biphenyls (PCBs)

When light fixtures are removed, examine the ballasts for PCB content. If ballasts are not clearly labelled as “non-PCB” or are suspected to contain PCBs, handle in accordance with SOR/2008-273.

Liquid in mineral oil transformers should be sampled immediately prior to demolition to ensure the fluid was not contaminated with PCB-containing fluid in the past.

PCB materials and liquids that are removed as a result of planned demolition are to be packaged in accordance with SOR/2008-273 and incinerated at a provincially or federally permitted destruction facility.

4.7 Mould

Mould is not required to be removed if the building will be demolished, however, the if the buildings will not be demolished, remove mouldy drywall on the exterior wall at the doorway in the Generator Room and surface mould on painted concrete in the Breaker Closet using Level 1 Mould Remediation Procedures as outlined in the EACO (Environmental Abatement Council of Ontario) Mould Abatement Guidelines, Edition 2 (2010).

5.0 LIMITATIONS

This report details the hazardous building materials found within or forming part of the building envelope. The assessment only included inspections of the structure and finishes, including mechanical equipment. The assessment did not include inspection of current or past owner or occupant articles within the building (i.e. process materials or equipment, portable equipment, curriculum items, etc.) and does not report on possible contaminants in the soil and groundwater of the site, underground storage tanks, buried piping, inside drums, vessels, production equipment, or in areas not accessed by the surveyor.

The work performed by Pinchin was conducted in accordance with generally accepted engineering or scientific practices current in this geographical area at the time the work was performed. The Client acknowledges that subsurface and concealed conditions may vary from those encountered or inspected. Pinchin can only comment on the environmental conditions observed on the date(s) the assessment is performed. The work is limited to those materials or areas of concern identified by the Client or outlined in our proposal. Other areas of concern may exist but were not investigated within the scope of this assignment.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretations and these interpretations may change over time and we undertake no, and expressly disclaim, obligation to advise the Client of such change. Pinchin accepts no responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The degree of mould growth noted in the report may change with time if water or humidity issues continue or develop after the assessment date(s). Any sources of water infiltration or high humidity must be corrected to prevent the continuation or occurrence of mould growth.

No warranty is either expressed or implied, or intended by this agreement or by furnishing oral or written reports or findings. The liability of Pinchin or our officers, directors, shareholders or staff will be limited to the lesser of the fees paid or actual damages incurred by the Client.

Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be liable for damages resulting from negligence of Pinchin. Pinchin will not be liable for any losses or damage if client has failed, within a period of (2) years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Consultant to recover such losses or damage.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party other than the Client, unless the Client, in writing, requests information to be provided to a third party or unless disclosure by Pinchin is required by law. Unless consented to by Pinchin, which consent may be reasonably and/or arbitrarily withheld, any use by a third party, of reports or documents authored by Pinchin, or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted by any party.

6.0 CLOSURE

Should there be any questions regarding the contents of this report, please contact Damian Palus at 905-577-6206 ext. 1725.

Yours truly,

Pinchin Environmental Ltd.

Prepared by:

per: Leslie Cantar, B. Eng. Mgt, EIT
Project Technologist
Hazardous Materials Group
lcantar@pinchin.com

Reviewed by:

per: Damian Palus, C.E.T.
Operations Manager
Hazardous Materials Group
dpalus@pinchin.com

J:\92000s\92340 Fisheries,PortWeller,StCath,ASB,ASSMT\Report\92340 DFO Port Weller St Catharines HazMat Report April 3 2014.docx

APPENDIX I
FRIABILITY AND REGULATIONS

1.0 FRIABILITY

As per regulation 278/05, "friable material" means material that, (a) when dry, can be crumbled, pulverized or powdered by hand pressure, or (b) is crumbled, pulverized or powdered. Asbestos-containing material (ACM) that is friable has a much greater potential than non-friable ACM to release airborne asbestos fibres when disturbed. The most common friable ACM used in the past are surfacing materials (usually sprayed fireproofing, texture, decorative or acoustic sprayed finishes) and thermal insulations on mechanical systems. Asbestos-containing non-friable materials include vinyl floor tiles, drywall joint compound, gasket materials, asbestos cement pipe or board, asbestos textiles, etc. Note that though a product may be considered non-friable when new, if the product releases fine dust due to deterioration or during removal, the free dust is considered friable. Potentially friable materials (or sometimes called miscellaneous friable materials) include materials such as ceiling tiles and plaster. These materials are non-friable in place, but can generate dust upon removal.

2.0 TABLE 1 REGULATION 278/05 – ASBESTOS SAMPLING FREQUENCY

Type of Material	Size of Area of Homogeneous Material	Minimum Number of Samples
Surfacing material, including without limitation material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings, fireproofing materials on structural members and plaster	Less than 90 square metres	3
	90 or more square metres, but less than 450 square metres	5
	450 or more square metres	7
Thermal insulation, except as described below	Any size	3
Thermal insulation patch	Less than 2 linear metres or 0.5 square metres	1
Other material	Any size	3

3.0 REGULATIONS - ONTARIO

Section 30 of the Occupational Health and Safety Act requires building owners or their agents (architects, general contractors, construction managers, etc.) to prepare or have prepared, a list of designated substances present in the area of construction or facility undergoing construction

work. There are eleven designated substances subject to special regulation under the Occupational Health and Safety Act. Of these eleven, asbestos, lead, mercury, and silica are commonly found in buildings and can impact construction, demolition, and renovation projects. The owner must ensure that a prospective constructor has received a designated substance report before entering into a binding contract with the constructor/contractor.

The disturbance of asbestos-containing materials (ACM) on construction projects is controlled by Ontario Ministry of Labour Regulation 278/05 made under the Occupational Health and Safety Act (Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations). The Regulation classifies all disturbances as Type 1, Type 2, or Type 3, each of which has defined work practices. All ACM are subject to special handling and disposal, and must be removed before partial or full demolition. The Ministry of Labour must be notified prior to any project involving removal of more than a minor amount of friable ACM (Type 3 or Glove Bag abatement).

The Ministry of Labour released two documents in December 2004, Ministry of Labour Guideline - Lead on Construction Projects, and Ministry of Labour Guideline - Silica on Construction Projects. Although these documents were not released as Regulations, to quote the Ministry of Labour *"These guidelines will raise awareness of the potential hazards associated with Lead and Silica for common construction activities and tasks, and will provide assistance to employers, constructors and workers in how to take reasonable precautions to protect workers from exposure to Lead and Silica. These Guidelines include specific measures and procedures for typical construction activities and operations and can be used as best practices by the industry."* These guidelines are expected to be widely enforced by the Ministry of Labour, via the general duty clause 25 (2) (h) of the Occupational Health and Safety Act, since there is no other construction regulation regarding lead and silica available for them to draw upon as a resource. The Ministry of Labour has also issued guidelines or proposed regulations for coal tar products and handling of mercury on construction sites.

Management, handling and transfer of PCBs are controlled by R.R.O. 1990, Reg. 362, Waste Management-PCB's Regulation, made under the Ontario Environmental Protection Act, and the PCB Regulation (SOR/2008-273) made under the federal Environmental Protection Act.

The Ontario Ministry of Labour published the hazard alert "Mould in Workplace Buildings", in December 2000. To quote from the alert, "The sustained and/or extensive growth of any visible mould on the interior surfaces of a building is unacceptable. Mould growth on the interior surfaces of buildings is a risk factor for health problems." The Ministry of Labour has enforced work stoppages as a result of indoor mould growth and has enforced removal using work practices similar to those required for asbestos abatement.

Waste disposal is controlled by Ministry of the Environment Regulation, R.R.O. 1990 Reg. 347 as amended.

APPENDIX II

RESULTS OF BULK SAMPLE ANALYSIS FOR ASBESTOS

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar
Chris Mego

Project: 92340, Fisheries and Oceans Canada,
Port Weller, St. Catharines

Lab Order ID: 1404815
Analysis ID: 1404815_PLM
Date Received: 3/19/2014
Date Reported: 3/24/2014
Date Amended: *4/1/2014*

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
0001A / *1404815PLM_1*	Drywall joint compound on wall, Living Room, Galley House	**None Detected**		**100% Other**	White, Non Fibrous, Homogeneous / Crushed
0001B / *1404815PLM_2*	Drywall joint compound on wall, Workout Room, Galley House	**None Detected**		**100% Other**	White, Non Fibrous, Homogeneous / Crushed
0001C / *1404815PLM_3*	Drywall joint compound on wall, Workshop/Garage, Galley House	**None Detected**		**100% Other**	White, Non Fibrous, Homogeneous / Crushed
0002A - A / *1404815PLM_4*	Smooth plaster on wall, Closet in Cabin #3, Office House / *finish*	**None Detected**		**100% Other**	White, Non Fibrous, Homogeneous / Crushed
0002A - B / *1404815PLM_27*	Smooth plaster on wall, Closet in Cabin #3, Office House / *base*	**None Detected**	**2% Cellulose**	**78% Other** **20% Quartz**	Gray, Non Fibrous, Homogeneous / Crushed
0002B - A / *1404815PLM_5*	Smooth plaster on wall, Closet in Cabin #3, Office House / *finish*	**None Detected**		**100% Other**	White, Non Fibrous, Homogeneous / Crushed
0002B - B / *1404815PLM_28*	Smooth plaster on wall, Closet in Cabin #3, Office House / *base*	**None Detected**	**2% Cellulose**	**78% Other** **20% Quartz**	Gray, Non Fibrous, Homogeneous / Crushed
0002C - A / *1404815PLM_6*	Smooth plaster on wall, Closet in Cabin #4, Office House / *finish*	**None Detected**		**100% Other**	White, Non Fibrous, Homogeneous / Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 1.0%.

Bethany Nichols (32)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar
Chris Mego

Project: 92340, Fisheries and Oceans Canada,
Port Weller, St. Catharines

Lab Order ID: 1404815
Analysis ID: 1404815_PLM
Date Received: 3/19/2014
Date Reported: 3/24/2014
Date Amended: *4/1/2014*

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
0002C - B	Smooth plaster on wall, Closet in Cabin #4, Office House	None Detected	2% Cellulose	78% Other 20% Quartz	Gray Non Fibrous Homogeneous
1404815PLM_29	*base*				Crushed
0002D - A	Smooth plaster on wall, Supernumary Cabin, Office House	None Detected		100% Other	White Non Fibrous Homogeneous
1404815PLM_7	*finish*				Crushed
0002D - B	Smooth plaster on wall, Supernumary Cabin, Office House	None Detected	2% Cellulose	78% Other 20% Quartz	Gray Non Fibrous Homogeneous
1404815PLM_30	*base*				Crushed
0002E - A	Smooth plaster on ceiling, Closet in Supernumary Cabin, Office House	None Detected		100% Other	White Non Fibrous Homogeneous
1404815PLM_8	*finish*				Crushed
0002E - B	Smooth plaster on ceiling, Closet in Supernumary Cabin, Office House	None Detected	2% Cellulose	78% Other 20% Quartz	Gray Non Fibrous Homogeneous
1404815PLM_31	*base*				Crushed
0003A	Vinyl sheet flooring below carpet, Supernumary Cabin, Office House	None Detected	50% Cellulose	50% Other	Gray, Black Fibrous Heterogeneous
1404815PLM_9					Teased
0003B	Vinyl sheet flooring below carpet, Supernumary Cabin, Office House	None Detected	50% Cellulose	50% Other	Gray, Black Fibrous Heterogeneous
1404815PLM_10					Dissolved, Teased
0003C - A	Vinyl sheet flooring below carpet, Entranceway, Office House	None Detected	50% Cellulose	50% Other	Tan Fibrous Heterogeneous
1404815PLM_11	*sheet vinyl*				Dissolved, Teased

Bethany Nichols (32)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar
Chris Mego

Project: 92340, Fisheries and Oceans Canada,
Port Weller, St. Catharines

Lab Order ID: 1404815
Analysis ID: 1404815_PLM
Date Received: 3/19/2014
Date Reported: 3/24/2014
Date Amended: *4/1/2014*

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
0003C - B	Vinyl sheet flooring below carpet, Entranceway, Office House	**None Detected**		**100% Other**	Brown Non Fibrous Homogeneous
1404815PLM_32	*mastic*				Dissolved
0004A	White caulking at window frame, Basement, Office House	**2% Chrysotile**		**98% Other**	White Non Fibrous Homogeneous
1404815PLM_12					Dissolved
0004B	White caulking at window frame, First Floor, Office House	**Not Analyzed**			
1404815PLM_13					
0004C	White caulking at window frame, First Floor, Office House	**Not Analyzed**			
1404815PLM_14					
0005A	Rough plaster on exterior walls, Office House	**None Detected**		**100% Other**	Gray Non Fibrous Homogeneous
1404815PLM_15					Crushed
0005B	Rough plaster on exterior walls, Office House	**None Detected**		**100% Other**	Gray Non Fibrous Homogeneous
1404815PLM_16					Crushed
0005C	Rough plaster on exterior walls, Connection between Houses	**None Detected**		**100% Other**	Gray Non Fibrous Homogeneous
1404815PLM_17					Crushed
0006A	Caulking at basement window, Exterior, Office House	**5% Chrysotile**		**95% Other**	Gray Non Fibrous Homogeneous
1404815PLM_18					Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 1.0%.

Bethany Nichols (32)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar
Chris Mego

Project: 92340, Fisheries and Oceans Canada,
Port Weller, St. Catharines

Lab Order ID: 1404815
Analysis ID: 1404815_PLM
Date Received: 3/19/2014
Date Reported: 3/24/2014
Date Amended: *4/1/2014*

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
0006B / *1404815PLM_19*	Caulking at base of wall, Exterior, Galley House	**Not Analyzed**			
0006C / *1404815PLM_20*	Caulking at window frame, Exterior, Galley House	**Not Analyzed**			
0007A / *1404815PLM_21*	Tar paper at wall connection between Garage and Office House, Exterior	**None Detected**	**50% Cellulose**	**50% Other**	Black Fibrous Heterogeneous Dissolved, Teased
0007B / *1404815PLM_22*	Tar paper at wall connection between Garage and Office House, Exterior	**None Detected**	**50% Cellulose**	**50% Other**	Black Fibrous Heterogeneous Dissolved, Teased
0007C / *1404815PLM_23*	Tar paper at wall connection between Garage and Office House, Exterior	**None Detected**	**50% Cellulose**	**50% Other**	Black Fibrous Heterogeneous Dissolved, Teased
0008A / *1404815PLM_24*	Black caulking on parapet, Upper Roof over Galley House	**None Detected**		**100% Other**	Black Non Fibrous Homogeneous Dissolved
0008B / *1404815PLM_25*	Black caulking on parapet, Upper Roof over Galley House	**None Detected**		**100% Other**	Black Non Fibrous Homogeneous Dissolved
0008C / *1404815PLM_26*	Black caulking on parapet, Upper Roof over Galley House	**None Detected**		**100% Other**	Black Non Fibrous Homogeneous Dissolved

Bethany Nichols (32)

Analyst

Approved Signatory

1404813

Version 1-15-2012

Client:	Pinchin Environmental Ltd.
Contact:	Leslie Cantar/Chris Mego
Address:	875 Main Street W., Unit 11
	Hamilton, ON L8S 4R9
Phone:	905-577-6206
Fax:	905-577-6207
Email:	lcantar@pinchin.com
	cmego@pinchin.com
Project:	92340, Fisheries and Oceans Canada, Port Weller, St. Catharines
Client Notes:	
P.O. #:	92340
Date Submitted:	Mar 18.14
Analysis:	PLM - Stop Positive
Turnaround Time:	4 days

Instructions

Enter samples between "<<" and ">>"

Only Data 1 and Data 2 are ...

Scientific Analysis Institute

504 Dundas ... 407 ... Greensboro ...

Sample Number	Data 1 (Lab use only)	Sample Description	Data 2 (Lab use only)
<<			
0001A		Drywall joint compound on wall, Living Room, Galley House	
0001B		Drywall joint compound on wall, Workout Room, Galley House	
0001C		Drywall joint compound on wall, Workshop/Garage, Galley House	
0002A		Smooth plaster on wall, Closet in Cabin #3, Office House	
0002B		Smooth plaster on wall, Closet in Cabin #3, Office House	
0002C		Smooth plaster on wall, Closet in Cabin #4 Office House	
0002D		Smooth plaster on wall, Supernumary Cabin, Office House	
0002E		Smooth plaster on ceiling, Closet in Supernumary Cabin, Office House	
0003A		Vinyl floor tile below carpet, Supernumary Cabin, Office House	
0003B		Vinyl floor tile below carpet, Supernumary Cabin, Office House	
0003C		Vinyl floor tile below carpet, Entranceway, Office House	
0004A		White caulking at window frame, Basement, Office House	
0004B		White caulking at window frame, First Floor, Office House	
0004C		White caulking at window frame, First Floor, Office House	
0005A		Rough plaster on exterior walls, Office House	
0005B		Rough plaster on exterior walls, Office House	
0005C		Rough plaster on exterior walls, Connection between Houses	
0006A		Caulking at basement window, Exterior, Office House	
0006B		Caulking at base of wall, Exterior, Galley House	
0006C		Caulking at window frame, Exterior, Galley House	
0007A		Tar paper at wall connection between Garage and Office House, Exterior	
0007B		Tar paper at wall connection between Garage and Office House, Exterior	
0007C		Tar paper at wall connection between Garage and Office House, Exterior	
0008A		Black caulking on parapet, Upper Roof over Galley House	
0008B		Black caulking on parapet, Upper Roof over Galley House	
0008C		Black caulking on parapet, Upper Roof over Galley House	
>>			

Accepted ☑

Rejected ☐

3.19 1000

APPENDIX III

RESULTS OF TESTING FOR LEAD IN PAINT

Analysis for Lead Concentration in Paint Chips

by Flame Atomic Absorption Spectroscopy
EPA SW-846 3rd Ed. Method No. 3050B/Method No. 7420

AIHA LAP, LLC ACCREDITED LABORATORY ENVIRONMENTAL LEAD ISO/IEC 17025:2005 www.aihaaccreditedlabs.org LAB #173190

Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar
Chris Mego

Lab Order ID: 1404813
Analysis ID: 1404813_PBP
Date Received: 3/19/2014
Date Reported: 3/26/2014

Project: 92340; Fisheries Port Weller, St. Catherines, Ontario

Sample ID *Lab Sample ID*	Description *Lab Notes*	Mass *(g)*	Analytical Sensitivity *(% by weight)*	Concentration *(% by weight)*
L001 1404813PBP_1	White paint of drywall wall, cabin #2	0.0613	0.002%	**0.52%**
L002 1404813PBP_2	Beige paint on concrete wall, breaker closet	0.0300	0.045%	**15%**
L003 1404813PBP_3	Grey paint on concrete, shop/garage	0.1382	0.001%	**0.48%**
L004 1404813PBP_4	White paint on plywood wall, basement office house 1	0.0677	0.002%	**0.095%**
L005 1404813PBP_5	Blue paint on drywall walls, first floor corridor	0.0214	0.003%	**< 0.007%**
L006 1404813PBP_6	Blue-grey paint on wood, exterior building 2	0.0724	0.002%	**0.14%**
L007 1404813PBP_7	Grey paint on wall, exterior building 1	0.0440	0.031%	**16%**
L008 1404813PBP_8	White paint on door frame, exterior	-	**Insufficient Sample**	
L009 1404813PBP_9	Black paint on window sill, exterior building 1	0.0565	0.024%	**3.7%**

Kristin Cooke (9)
Analyst

Laboratory Director

140813

Version 1-15-2012

Client:	Pinchin Environmental Ltd.
Contact:	Leslie Cantar, Chris Mego
Address:	11-875 Main St W, Hamilton, ON
Phone:	905-577-6206 ext 1706
Fax:	905-577-6207
Email:	lcantar@pinchin.com, cmego@pinchin.com
Project:	92340 Fisheries Port Weller St. Catharines, Ontario
Client Notes:	% lead by weight
P.O. #:	92340
Date Submitted:	3/17/2014 0:00
Analysis:	% lead by weight
TurnAroundTime:	5 day (Regular)

Instructions:

Use Column "B" for your contact info

To See an Example Click the bottom Example Tab.

Enter samples between "<<" and ">>"

Begin Samples with a "<< "above the first sample and end with a ">>" below the last sample.

Only Enter your data on the first sheet "Sheet1"

Note: Data 1 and Data 2 are optional fields that do not show up on the official report, however they will be included in the electronic data returned to you to facilitate your reintegration of the report data.

Scientific Analytical Institute

4604 Dundas Drive
Greensboro, NC 27407
Phone: 336.292.3888
Fax: 336.292.3313
Email: lab@sailab.com

Sample Number	Data 1 (Lab use only)	Sample Description	Data 2 (Lab use only\)
<<			
L001	White paint of drywall wall, Cabin #2		[Enter data of your choosing here]
L002	Beige paint on conrete wall, Breaker Closet		[Enter data of your choosing here]
L003	Grey paint on concrete, Shop/Garage		[Enter data of your choosing here]
L004	White paint on plywood wall, Basement Office House 1		[Enter data of your choosing here]
L005	Blue paint on drywall walls, First Floor Corridor		[Enter data of your choosing here]
L006	Blue-grey paint on wood, Exterior Building 2		[Enter data of your choosing here]
L007	Grey paint on wall, Exterior Building 1		[Enter data of your choosing here]
L008	White paint on door frame, Exterior		[Enter data of your choosing here]
L009	Black paint on window sill, Exterior Building 1		[Enter data of your choosing here]
>>			

3/19
10A

APPENDIX IV
PHOTOGRAPHS

Photo 1
Non-asbestos foam insulation on domestic hot water piping, Connecting Garage

Photo 2
Uninsulated ductwork, Basement of Office House

Photo 3
Uninsulated furnace, Furnace Room, Galley House

Photo 4
Non-asbestos 24” x 24” lay-in fibreglass ceiling tiles, Exercise Room, Galley House

Photo 5
Non-asbestos rough plaster (samples 0005A-C), Exterior, Office House

Photo 6
Non-asbestos vinyl sheet flooring present below carpet (samples 0003A-C), Entranceway, Office House

Photo 7
Non-asbestos 12” x 12” vinyl floor tiles, brown fleck pattern (Install Date 1999), Basement, Office House

Photo 8
Asbestos-containing white window caulking (sample 0004A), Exterior, Galley House

Photo 9
Asbestos-containing grey caulking (sample 0006A), Exterior, Office House

Photo 10
Non-asbestos black caulking at parapets (samples 0008A-C), Roof, Galley House

Interior caulking not present at interior window frames, Cabin #1, Galley House

Photo 12
Non-asbestos modified bitumen flat roofing, Galley House

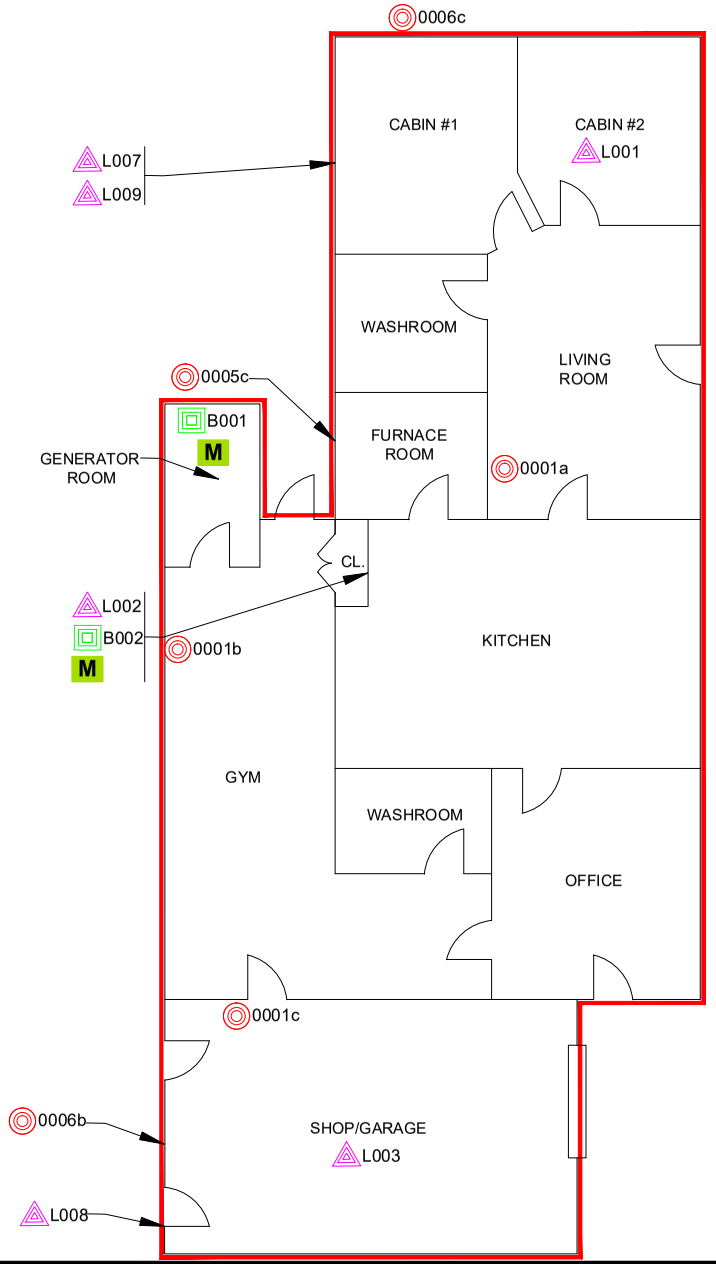
Photo 13
Flaking lead-containing paint on concrete walls (L006 to L009), Exterior, Galley House

Photo 14
Mould present on water-damaged drywall (sample B-001), Generator Room, Galley House

Photo 15
Surface mould present on concrete wall (sample B-002), Breaker Closet, Galley House

APPENDIX V

DRAWINGS



LEGEND:

- ASBESTOS SAMPLE LOCATION
- LEAD SAMPLE LOCATION
- MOULD SAMPLE LOCATION
- PCB SAMPLE LOCATION
- M — APPROX. LOCATION OF MOULD CONTAMINATED MATERIAL
- A-C CAULKING

NOTES:
1) SAMPLES 0008a-c AND P003 WERE COLLECTED ON THE ROOF.

CLIENT:
FISHERIES AND OCEANS CANADA
501 UNIVERSITY CRES.
WINNIPEG, MANITOBA

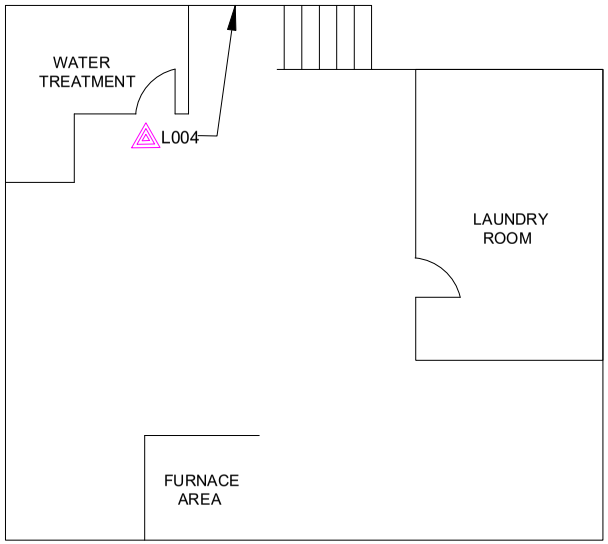
PINCHIN ENVIRONMENTAL
875 Main Street West, Unit 11
Hamilton, Ontario
Phone: 905 577 6206 Fax: 905 577 6207

PROJECT NAME:
PORT WELLER
SEARCH AND RESCUE
ST. CATHARINES, ONTARIO

DRAWING NAME:
HAZARDOUS MATERIALS ASSESSMENT
GALLEY HOUSE

SCALE:	PROJECT NUMBER:
NTS	92340
DATE:	REVISION NUMBER:
2014/04/04	
DRAWN BY:	CHECKED BY:
CDM	LNC

DRAWING NO:
DS-01



LEGEND:

LEAD SAMPLE LOCATION

NOTES:

CLIENT:

FISHERIES AND OCEANS
CANADA
501 UNIVERSITY CRES.
WINNIPEG, MANITOBA

PINCHIN ENVIRONMENTAL
875 Main Street West, Unit 11
Hamilton, Ontario
Phone: 905 577 6206 Fax: 905 577 6207

PROJECT NAME:

PORT WELLER
SEARCH AND RESCUE
ST. CATHARINES, ONTARIO

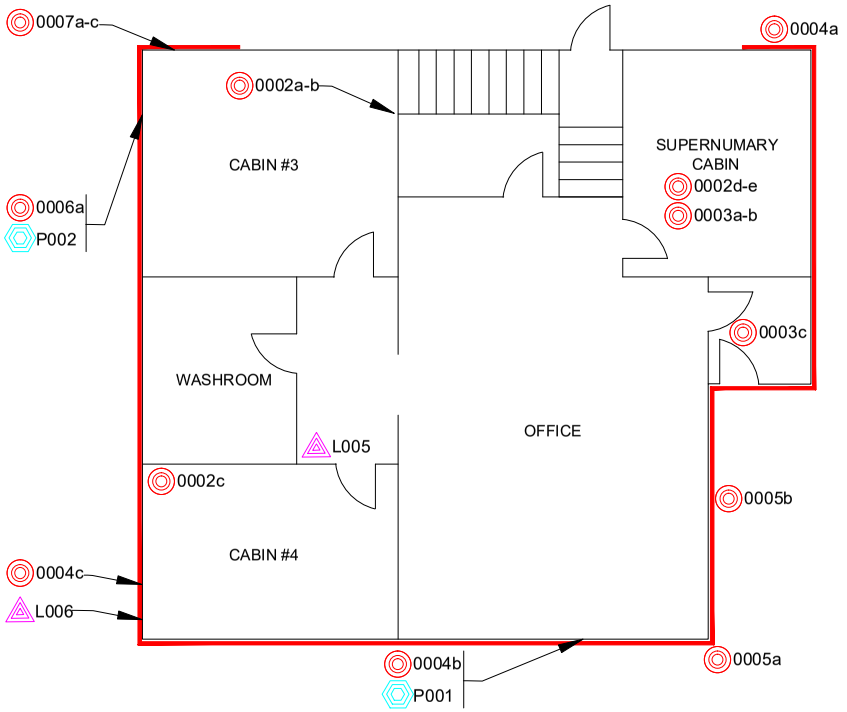
DRAWING NAME:

HAZARDOUS MATERIALS
ASSESSMENT
OFFICE HOUSE - BASEMENT

SCALE:	PROJECT NUMBER:
NTS	92340
DATE:	REVISION NUMBER:
2014/04/04	
DRAWN BY:	CHECKED BY:
CDM	LNC

DRAWING NO:

DS-02



LEGEND:

- ASBESTOS SAMPLE LOCATION
- LEAD SAMPLE LOCATION
- PCB SAMPLE LOCATION
- A-C CAULKING

NOTES:

CLIENT:

FISHERIES AND OCEANS CANADA
501 UNIVERSITY CRES.
WINNIPEG, MANITOBA

PINCHIN ENVIRONMENTAL
875 Main Street West, Unit 11
Hamilton, Ontario
Phone: 905 577 6206 Fax: 905 577 6207

PROJECT NAME:

PORT WELLER
SEARCH AND RESCUE
ST. CATHARINES, ONTARIO

DRAWING NAME:

HAZARDOUS MATERIALS ASSESSMENT
OFFICE HOUSE - FIRST FLOOR

SCALE:	PROJECT NUMBER:
NTS	92340
DATE:	REVISION NUMBER:
2014/04/04	
DRAWN BY:	CHECKED BY:
CDM	LNC

DRAWING NO:

DS-03

APPENDIX VI
RESULTS OF BULK SAMPLE ANALYSIS FOR MOULD AND PCBS

PINCHIN ENVIRONMENTAL

2470 Milltower Court
Mississauga, ON L5N 7W5
Tel: (905) 363-0678
Fax: (905) 363-0681

THE PINCHIN GROUP

AIHA LAP, LLC
ACCREDITED LABORATORY
ENVIRONMENTAL MICROBIOLOGY
ISO/IEC 17025:2005
www.aihaaccreditedlabs.org
LAB #158835

Pinchin Environmental Microbiology Laboratory

Certificate of Analysis

CUSTOMER: Leslie Cantar, Chris Mego
COMPANY: Pinchin Environmental Ltd
ADDRESS: 875 Main Street West, Unit 11
Hamilton, ON L8S 4R9

PROJECT NAME: DFO Port Weller, St. Catharines
PROJECT NO.: 92340
LAB REFERENCE NO.: m56519
TYPE OF SAMPLE(S): BULK
SAMPLE CONDITION: Acceptable
DATE COLLECTED: March 17, 2014
DATE RECEIVED: March 19, 2014
DATE ANALYSED: March 24, 2014
DATE REPORTED: March 24, 2014
ANALYST: Jaybeeramy Naiken, B.Sc.
TITLE: Environmental Microbiologist
REVIEWER: Inesa Liashko B. Eng.
TITLE: Environmental Microbiologist

Method of Analysis: Analysis of Bulk and Tape-lift Samples by Direct Microscope Examination (SOP: DME-BLK-004, December 17, 2013)

This SOP is based on methods described in: "AIHA's Field Guide for Determination of Biological Contaminants in Environmental Samples", "Samson et al's Food and Indoor Fungi", and the "IRRST method 360". Bulk samples are scanned under a stereomicroscope for the presence of mould growth; cellotape samples taken from these are mounted on glass slides and examined under light microscope at X400, X600 (630) or X1000 magnifications as appropriate. Moulds are identified to the genus using keys in relevant books and literature. Mould growth is assessed as Heavy, Moderate or Slight by examining the mycelium cover on the sample and/or the slide preparations. Some moulds may be difficult to identify from bulk samples and these are reported as "Unidentified mould". Spores observed in the absence of an established mycelium are identified whenever possible and rated as "few" for 5-50 spores or "masses" for >50 spores. Results are not corrected for blanks. Estimation of uncertainty is provided upon request.

COMMENTS/OBSERVATIONS (IF ANY):

Notes: 1. The result(s) relate only to the sample(s) tested.
2. This test report shall not be reproduced except in full, without written approval of the laboratory.
3. Services are subject to Pinchin Environmental Ltd. Standard Terms and Conditions for Laboratory Services.

PINCHIN ENVIRONMENTAL

2470 Milltower Court
Mississauga, ON L5N 7W5
Tel: (905) 363-0678
Fax: (905) 363-0681

THE PINCHIN GROUP

AIHA LAP, LLC
ACCREDITED LABORATORY
ENVIRONMENTAL MICROBIOLOGY
ISO/IEC 17025:2005
www.aihaaccreditedlabs.org
LAB #158835

Pinchin Environmental Microbiology Laboratory

Certificate of Analysis

CUSTOMER: Leslie Cantar, Chris Mego
PROJECT NAME: DFO Port Weller, St. Catharines
LAB REFERENCE NO: m56519
PROJECT NO.: 92340
DATE ANALYSED: March 24, 2014
ANALYST: Jaybeeramy Naiken, B.Sc.

RESULTS FOR BULK DME ANALYSIS

Customer Sample No.	Lab Sample ID.	Description	Mould Identified, in Rank Order	Comments (if any)
B-001	m56519-1	Drywall and paper at door to exterior, generator room, Galley House	*Cladosporium* sp *Dicyma* sp Aspergillus/Penicillium sp (a few spores)	Moderate growth
B-002	m56519-2	Paint on concrete wall, breaker closet in workout room, Galley House	*Cladosporium* sp	Heavy growth

Signature of Analyst:

MS6519

PINCHIN ENVIRONMENTAL

REQUEST FOR ANALYTICAL SERVICES

REPORT RESULTS TO			
Contact:	Leslie Cantar, Chris Mego	Dept: Hazardous Materials Management	
Company:	Pinchin Environmental Hamilton Office	Telephone No.: 905-577-6206	Fax No.: 905-577-6207
Mailing Address:	875 Main Street West Unit 11	Email: lcantar@pinchin.com; cmego@pinchin.com	
City, Prov., Postal Code:	Hamilton, Ontario, L8S 4R1	Client Job/Purchase Order No.: 92340	
Special Instructions:		Project: DFO Port Weller St Catharines, Ontario	
Report By: Mail ☐ Email ☐ Fax ☐	No. Samples Submitted: 2	Invoice To: n/a	

Sample #	Description	Date Sampled	Where Applicable: Total Air Volume (L)	Where Applicable: Swab & Dust Area (cm^2)	ANALYSIS REQUESTED: Indicate service required, and if **RUSH** Please submit field blanks for all media	RUSH	FOR LAB USE ONLY LAB #
B-001	Drywall and paper at door to exterior, Generator Room, Galley House	17-Mar-14			DME Fungal Particulate Only	NO	MS6519-1
B-002	Paint on concrete wall, Breaker Closet in Workout Room, Galley House	17-Mar-14			DME Fungal Particulate Only	NO	MS6519-2

Chain of Custody				
Collected by:	Leslie Cantar		Collector's Signature:	
Relinquished by: LNC	Date/Time: 17-Mar-14		Received by:	Date/Time:
Relinquished by:	Date/Time:		Received by:	Date/Time:
Method of Shipment:	courier		Received at Lab by:	MT 3/19/14 11:23AM
Authorized by: _____ (Client Signature **MUST** Accompany Request)	Date March 17, 2014		Sample Condition Upon Receipt:	Acceptable ☑ Other (explain) ☐

Revision: September 2003

DISTRIBUTION: White = Pinchin Laboratory Yellow = Client Copy Pink = Client Copy

Rec. by 23/24/14

AEVITAS INC. (AYR) - ANALYTICAL CHEMISTRY LABORATORY
75 WANLESS COURT, AYR, ONTARIO, N0B 1E0, CANADA
WWW.AEVITAS.CA

Certificate of Analysis

Leslie Cantar

Pinchin Environmental Ltd. (Hamilton)
11-875 Main Street West, Unit 11, Hamilton, ON L8S 4R9

Printed: Mar 21, 2014

Special Notes: *Project: DFO Port Weller HazMat Assessment - (Project #: 92340)*

3 caulking samples were submitted for the following analysis from Port Weller, St. Catharines, Ontario.

Date Sampled: Mar 17, 2014 **Date Tested:** Mar 21, 2014 **Sampled by:** Leslie Cantar

Report Number: 14-0408

Sample #	Analyte	Result	Units	MDL	Comments	Technique / Test Method
1	*Sample ID.:* ***P001 - White caulking at windows, Exterior, Office House***					
	PCBs in Solid	**<0.5**	mg/kg	0.5		LAB-M06 (EPA 3550C/8082A modified)
2	*Sample ID.:* ***P002 - Caulking at windows and base of wall, Exterior, Office House***					
	PCBs in Solid	**<0.5**	mg/kg	0.5		LAB-M06 (EPA 3550C/8082A modified)
3	*Sample ID.:* ***P003 - Black caulking at metal parapet, Upper Roof, …***					
	PCBs in Solid	**<0.5**	mg/kg	0.5		LAB-M06 (EPA 3550C/8082A modified)
	Comment(s)	**-**	N/A	N/A	"mg/kg" is equivalent to "ppm"	N/A

Results relate only to the samples tested above, as received.

Approved By:

Son C.H. Le, *B. Eng. (Chem.)*
Lab Manager
Phone: (519) 740-1333 Ext.: 230
Fax: (519) 740-2320
Email: SonLe@aevitas.ca

CCME PHASE I/II ENVIRONMENTAL SITE ASSESSMENT

Aqua Terre Solutions Inc.
1100 Sheppard Ave. W., Suite 200, Toronto, Ontario, Canada M3K 2B4
Tel (416) 635-5882 Fax (416) 635-5353 Internet: www.aquaterre.ca

CCME PHASE I / II ENVIRONMENTAL SITE ASSESSMENT SEARCH AND RESCUE STATION PORT WELLER, ONTARIO

FINAL REPORT

Prepared for:
Public Works and Government Services Canada
Department of Fisheries and Oceans

Prepared by:
Aqua Terre Solutions Inc.
Toronto, Ontario

File No.: 08228d February 11, 2009

EXECUTIVE SUMMARY

A Phase I/II ESA was completed at the Port Weller Canadian Coast Guard (CCG) Search and Rescue Station (SAR) located on the south shores of Lake Ontario, west of the entrance to the Welland Canal. The SAR site covers an area of approximately 1400 m^2. The site is owned by the St. Lawrence Seaway Management Corporation (SLSMC), is leased by the Department of Fisheries and Oceans (DFO) and operated by the Canadian Coast Guard. Infrastructure at the site includes: a boat launch ramp and breakwater, floating docks, a residence/office building, MNR building, six garage/storage buildings, an Environment Canada Hydrometric Gauging Station and fuel pumping facilities.

Fuel facilities include six (6) aboveground storage tanks (one aboveground gasoline storage tank, one aboveground waste oil storage tank, two aboveground fuel oil storage tanks, two aboveground diesel storage tanks, one of which has associated piping/dispenser for vessels). Sewage facilities include two underground septic holding tanks and septic leaching bed. These fuel and sewage facilities are operated by the Canadian Coast Guard.

The potential environmental concerns (PACs) identified in the Phase I ESA and carried forward to the Phase II ESA, are summarized as follows:

- PAC-1: Six ASTs are present on site. Soil and groundwater quality in the vicinity of these ASTs is unknown and should be evaluated.
- PAC-2: The quality of fill used to construct the breakwater is unknown. Fill quality should be evaluated in conjunction with PAC-1,
- PAC-3: The quality of sediments adjacent to the site is unknown and should be evaluated.

Phase II soil sampling was conducted with Pionjar drilling equipment in the vicinity of the ASTs. Soil samples were submitted for laboratory analyses of one or more of benzene, toluene, ethylbenzene and xylenes (BTEX), and petroleum hydrocarbon fractions (PHC F1 to F4), inorganics, PAHs, pH and grain size. One sample was collected from the potable water supply well at the SAR. An attempt to collect sediment samples with a Ponar sampler in the Welland Canal but there was insufficient sediment to sample.

The main findings of the Phase II ESA are summarized as follows:

- PAC-1: Boreholes were installed to assess soil quality on site and as close as practical to ASTs. No PHC soil impacts were encountered. It is concluded that the tanks have little subsurface impacts, if any.
- PAC-2: Shallow soil sampling of fill underlying the site was conducted in conjunction with soil sampling around the ASTs. No poor quality fill was encountered and it is concluded that fill quality is not a concern.
- PAC-3: Sediment sampling was attempted. However, there was insufficient sediment to sample and it is concluded that sediment quality is not a concern.
- Water sampled from the potable water supply well met Canadian Drinking Water Quality Guidelines except for sodium which is an aesthetic parameter.

General recommendation from this Phase I/II assessment are as follows:

a) Visual inspections of the ASTs should be conducted on a regular basis.
b) A Designated Substance Survey should be completed prior to any future construction or demolition on site.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

Aqua Terre Solutions Inc. (Aqua Terre) was retained by the Ontario Region of Public Works and Government Services Canada (PWGSC) on behalf of the Department of Fisheries & Oceans Canada (DFO), to carry out a Canadian Council of Ministers of the Environment (CCME) Phase I/II Environmental Site Assessment (ESA) and associated activities at the Port Weller Search and Rescue (SAR) Station located in Port Weller, Ontario. This work was completed under Standing Offer # Q447-05R935/009/TOR.

The Port Weller SAR is owned by the St. Lawrence Seaway Management Corporation (SLSMC), is leased by DFO and is operated by the Canadian Coast Guard (CCG). The harbour offers docking and fuelling facilities for Coast Guard and Police boats using Lake Ontario and the Welland Canal. The field components of the Phase I/II were completed in September 2008.

1.1 ASSESSMENT OBJECTIVES

The DFO objectives for this study as outlined in Terms of Reference for CCME Phase I/II Environmental Site Assessment and Associated Activities (TOR) (DFO, 2008) were as follows:

1. Complete a CCME Phase I ESA at the Port Weller SAR in order to identify and document the presence of sources or potential sources of soil, groundwater, surface water, or sediment contamination associated with past activities.

2. Collect information on the physical characteristics of the property for storage tanks and contaminated sites (CS) modules.

3. Complete a CCME Phase II ESA preliminary intrusive investigation at Port Weller SAR using manual methods to confirm the presence or absence of contamination at potential areas of concern identified in the historical review exercise.

4. Develop a *National Classification System (NCS)* score or *Aquatic Sites Ranking* for the contaminated site or area of concern.

5. Prepare an indicative estimate of liability associated with known contaminated sites, if possible.

6. Prepare an investigation program design with cost estimate in accordance with the TOR, if additional investigation is required to complete Objectives 2 through 4 above.

7. Prepare a Phase I/II ESA and associated activities report for the Port Weller SAR.

1.2 SCOPE OF WORK

The following tasks were undertaken to achieve the project objectives.

1.2.1 CCME Phase I Environmental Site Assessment

A historical review of activities on the subject property was completed in accordance with the principles of the CCME Phase I ESA as it relates to the identification of potential areas of concern associated with contamination. The Phase I ESA also followed the Canadian Standards Association standard Z768-01 Phase I Environmental Site Assessment, (CSA, 2001). Included in this task was a records review, interviews and a site visit. Further details on how this task was completed and sources of information reviewed are provided in Section 3.

1.2.2 CCME Phase II Environmental Site Assessment

The CCME Phase II ESA is a preliminary intrusive investigation of potential areas of concern identified in the Phase I ESA. This task was completed concurrently with the Phase I ESA site visit. The intrusive investigations were conducted in accordance with *Canadian Standards Association (CSA) Z790-00 Phase II Environmental Site Assessment* (CSA, 2000) and included the collection of soil samples using a portable drill and a potable water sample from the well on site. An attempt to collect sediment samples with a Ponar sampler in the Welland Canal but there was insufficient sediment to sample.

The purpose of sample collection is to confirm the presence/absence of contamination at the potential areas of concern and to provide information to enable subsequent sample programs, if required. Further details on how this task was completed are provided in Section 5.2.

1.2.3 Reporting

The results of the Phase I/II ESA and associated activities were documented in the format provided in Appendix F of the TOR. Findings, including nil findings, resulting from the investigations performed are included in this report. The report clearly identifies the potential areas of contamination or areas of contamination (if confirmed). Analytical results are compared to the applicable CCME guidelines referenced in the report.

1.3 OUTLINE OF REPORT

This report presents the results of this assessment and provides conclusions regarding the environmental conditions existing at the site, based on the information available at the time of the site investigations. Section 2 provides a general description of the site. Section 3 outlines the methodology used to collect the information for the Phase I ESA while Section 4 presents the

Phase I ESA findings. The methodology, results and conclusions of the Phase II ESA are presented in Section 5.

A summary is provided in Section 6, recommendations in Section 7 and general references in Section 8. Report limitations are provided in Section 9.

Site figures and tables summarizing site monitoring and analytical results are found following Section 9. Other supporting information follows in the Appendices.

2 DESCRIPTION OF SITE

2.1 GENERAL PROPERTY INFORMATION

1. Common Name	Port Weller Search and Rescue Station
2. SCH Region	Central & Arctic
3. Directory of Federal Real Property (DFRP) reference #	86422
4. Location	Ontario
	Lake Ontario and the Welland Canal (End of West Pier, Lock 1), Bunting Road
	Regional Municipality of Niagara
5. Geog. Coordinates	NAD 83, UTM Zone 17, 644621E, 4788605N

2.2 GENERAL DESCRIPTION OF SEARCH AND RESCUE STATION PROPERTY AND FACILITIES

The Port Weller SAR is located on the west breakwater between Lake Ontario and the Welland Canal in the Town of Port Weller (St. Catharines), Ontario (Figure 1).

The approximate location of leased property boundaries and on-site infrastructure are shown in Figure 2 which was prepared using an air photo provided by SLSMC and observations made during the Aqua Terre site visit. The SAR site covers an area of approximately 0.8 ha. The site is used as an office and residence for CCG workers while on-call and to serve the search and rescue vessels.

The SAR comprises a boat launch and breakwater to the northeast, floating docks to the southeast, an office/residence building to the west, six garage/storage buildings at various locations on the property and an Environment Canada Hydrometric Gauging Station. One of the small storage buildings is referred to as the MNR building. It was formerly used as an office for the gaming warden but is currently an office and tool storage for the CCG engineer.

Six aboveground storage tanks containing gasoline, diesel fuel, fuel oil or waste oil are present around the office/residence building. A dispensing pump and associated piping are present at the shed adjacent to the docks on the east portion of the site. Two drums containing bilge water are stored on the site. Two underground holding tanks for septic waste from the office/residence building are also to the east of the building.

The grounds are landscaped with grass, shrubs, trees and small vegetable gardens that are maintained by the CCG workers. The site is accessible through a main gate that is locked at all times and requires a security password to be typed into the gate keypad to gain entrance.

3 PHASE I ESA METHODOLOGY

The evaluation of the site consisted of three basic components: background research; consultation with individuals and agencies associated with the property; and a site reconnaissance (which was conducted simultaneously with the Phase II ESA).

3.1 BACKGROUND RESEARCH

The following historical information pertaining to the Port Weller SAR was collected and reviewed.

3.1.1 Historical Aerial Photographs

Historical aerial photographs available from the National Air Photo Library (operated by Natural Resources Canada) in Ottawa, Ontario were examined for the site and the surrounding areas. Copies of aerial photographs from 1927, 1934, 1948, 1959, 1966, 1974, 1986 and 1988 were obtained and evaluated for indicators of environmental significance. Selected reviewed photographs for 1927, 1948, 1966 and 1974 are provided in Appendix A.

3.1.2 PWGSC Files

The following reports were provided by PWGSC and reviewed by Aqua Terre to obtain relevant information pertaining to the site:

- Fisheries and Oceans Canada, Search and Rescue Station, Port Weller, Ontario, Building Condition Report, October 2001.
- CH2M Hill, Final Letter Report: Department of Fisheries and Oceans (DFO), Fuel Storage Tank Assessment and Upgrades Report, Port Weller Search and Rescue (SAR), Port Weller, Ontario. March 21, 2003.
- R.V. Anderson Associates Limited. Preliminary Engineer's Evaluation Report, PWGSC. Port Weller Coast Guard Base. March 2004.
- Public Works and Government Services Canada, Replacement of Underground Fuel Piping, Port Weller Search and Rescue Station, St. Catharines, Ontario, December 22, 2004.

3.1.3 EcoLog ERIS

Environmental Risk Information Services Ltd. (EcoLog ERIS) of Toronto, Ontario was contracted to electronically search available public environmental database records within a 250 m radius of the site. A complete list of databases searched is available in the EcoLog ERIS report provided in Appendix B.

3.2 CONSULTATION

In an effort to obtain information pertaining to the subject property and vicinity, the following agencies and/or individuals were contacted:

The Shumka Group

The Shumka Group of Toronto, Ontario was contacted to search the Historical Environmental Information Reporting System (HEIRS) database for fire insurance maps, inspection reports and site specific plans that contain information relating to the Port Weller SAR.

Technical Standards and Safety Authority

The Technical Standards and Safety Authority (TSSA) for the Province of Ontario was contacted to obtain information on fuel storage tanks and associated activities at the Port Weller SAR.

Ontario Ministry of the Environment

A freedom of information request was submitted to the Ministry of Environment (MOE) in Toronto, Ontario requesting environmental information including: general environmental concerns, orders, spills, investigations/prosecutions, and waste generator numbers/classes.

Ontario Ministry of Northern Development and Mines

Two maps from the Ontario Ministry of Northern Development and Mines (MNDM) were reviewed to obtain surficial and bedrock geology information for the site. Maps reviewed included:

- Map 2544, Bedrock Geology of Ontario, Southern Sheet (1991a)
- Map 2556, Quaternary Geology of Ontario, Southern Sheet (1991b)

Environment Canada

An Access to Information request was made to Environment Canada for environmental compliance and spills information relating to the Port Weller SAR.

Canadian Coast Guard

The CCG provided information on the history and construction of the Port Weller SAR station. The SAR CCG Commanding Officer was also interviewed.

Ontario Ministry of Natural Resources

The Ontario Ministry of Natural Resources' (MNR) Natural Heritage Information Centre Database was searched to identify the presence of any wetlands, areas of natural or scientific interest (ANSI), or species at risk within a one kilometre radius of the Port Weller SAR.

Canadian Wildlife Services

The Species at Risk registry of the Canadian Wildlife Services was accessed to assess endangered species potentially present in the general area.

Copies of correspondence are included in Appendix C.

3.3 SITE RECONNAISSANCE

A site visit was conducted on September 15, 2008 to document current conditions and to identify potential issues of environmental concern as viewed on the day of the assessment.

General site characteristics were observed and documented and are discussed in Section 4 of this report. A limited soil and potable water sampling program was conducted, as discussed in Section 5 of this report. Selected photographs taken during the site visit are presented in Appendix D.

3.3.1 Health and Safety Plan

A site specific health and safety plan was developed for the field program. Appropriate components of the plan were adopted from the Aqua Terre corporate Health and Safety Manual. All field workers were instructed on the protocols of the plan and the proper use of personal protective equipment. Worker health and safety standards were assured by following stringent safety precautions in accordance with the applicable sections specified under the Canada Labour Code and the Canada Health and Safety Act.

Potential hazards for this project included location of underground utilities, exposure to contaminated soil, work near open water and cold weather.

4 PHASE I ESA INFORMATION AND INTERPRETATION

4.1 SEARCH AND RESCUE STATION PROPERTY LAND USE PROFILE

4.1.1 Search and Rescue Station Facilities Historic Development and Uses

The information presented in this section has been obtained through the interpretation of aerial photographs, and records review. Copies of selected reviewed aerial photographs are provided in Appendix A. The original aerial photographs were taken at very high altitude and provide minimal interpretation

Aerial Photograph Summary

Date	Land Use/Notable Event	
	Search & Rescue Station Property	**Neighbouring Properties**
1927 Figure A.1 RA 15 72	The site is undeveloped with sparse vegetation. The breakwater appears to have been recently constructed.	The does not have any neighbours within 250m of the property. Lake Ontario is located immediately to the west and the Welland Canal immediately to the east.
1948 Figure A.2 A11612-40	One or more buildings appear to be present on site	Adjacent lands may have received additional fill and are more densely vegetated. No apparent changes were noted in adjacent waters.
1966 Figure A.3 A19384-55	Several buildings or structures appear on site. A communication tower that has been constructed to the north of the buildings.	A dock extends into the Welland Canal. No apparent changes were noted in waters to the west.
1974 Figure A.4 A23684-28	The site appears similar to the 1966 photograph although photo quality is very poor.	The dock to the east of the site is absent or not visible. No apparent changes were noted in waters to the west.

Property Use Documents

There were no fire insurance plans available from the Shumka Group, a copy of correspondence received from the Shumka Group is provided in Appendix C. No City Directories were reviewed since the site has not had previous property use.

4.1.2 Interviews/Consultation

This section provides information collected through interviews and consultations as they relate to historic operations at the Port Weller SAR and surrounding properties. Information gathered through interviews/consultation that applies to current operations is presented in the appropriate subsection of Sections 4.3 and 4.4.

Canadian Coast Guard

THE CCG Commanding Officer, Mr. David McGinnis, was interviewed on site. Information provided by the CCG is discussed in the relevant sections of the report. Relevant information received includes:

- Six (6) ASTs are located at the Port Weller SAR: 1-1,100L fuel oil, 1-910L diesel fuel, 1-935L fuel oil, 1-11,000L diesel fuel, 1-1900L gasoline and 1-500L waste oil (Figure 2); the Commanding Officer is not aware of which federal department owns these tanks;
- Two (2) underground septic tanks are located adjacent to the SAR building on the east side and the leaching bed is located in the gravel parking area north of the SAR building (Figure 2);
- Fill that originated from the construction of the Welland Canal was used to construct the breakwater upon which the site is located.

Technical Standards and Safety Authority

The TSSA was contacted and details concerning the Port Weller SAR were requested. Results from this request are pending. Findings will be forwarded to PWGSC upon receipt.

Ontario Ministry of the Environment

A search of MOE files was requested through the Freedom of Information and Protection of Privacy Act. The search included the files of the Ministry's Environmental Monitoring and Reporting Branch, Investigations and Enforcement Branch, Niagara District Office, SDW-Niagara and Sector Compliance Branch. Toronto District Office, Spills Action Centre, Investigations and Enforcement Branch, Environmental SWAT Team, Environmental Monitoring and Reporting Branch and the Environmental Assessment and Approvals Branch. Two files were found in relation to the Port Weller SAR. A copy of acknowledgement and files received from the MOE are provided in Appendix C.

Environment Canada

Environment Canada (EC) was contacted and an Access to Information request was submitted. Results from this request are pending. Findings will be forwarded to PWGSC upon receipt.

4.1.3 EcoLog ERIS Report

The EcoLog ERIS report identified the site in the O. Reg. 347 Generators Summary Database as a generator of light fuels, oil skimmings and sludges, waste oils and lubricants for the years 2002-2005 (Appendix B).

4.2 SEARCH AND RESCUE STATION PROPERTY PHYSICAL CHARACTERISTICS

4.2.1 Geology and Topography

Based on published information, the surficial geology of the surrounding area (excluding infilled areas) consists of glaciolacustrine deposits of sand, gravelly sand and gravel and near shore and beach deposits (MNDM, 1991a). The bedrock underlying the area is reported to be Ordovician or upper Ordovician shale, limestone, dolostone and siltstone (MNDM, 1991b). The depth of soil overlying bedrock is unknown.

The Port Weller SAR is located on the western breakwater where Lake Ontario enters the Welland Canal. The topography of the site is relatively flat.

4.2.2 Soils

The subject site is located on fill material that was reportedly from the construction of the adjacent Welland Canal. No records could be obtained regarding the source of the fill.

4.3 SEARCH AND RESCUE STATION PROPERTY BIOLOGICAL CHARACTERISTICS

The Port Weller SAR is located adjacent to a mixed-wood plains ecozone within a deciduous forest. A review of the Ontario Ministry of Natural Resources natural heritage information database revealed that there are no known occurrences of species at risk, rare vegetation communities or designated natural areas within one kilometre of the site. Located on the breakwater between Lake Ontario and the Welland Canal, all waters adjacent to the SAR station should be considered fish habitat and would contain an assemblage of warm and cold water fish species.

The Species at Risk registry of the Canadian Wildlife Services indicates that there are fifteen (15) endangered species potentially present in the general area including:

Species At Risk

Taxonomic Group	Species	Risk Level
Mammals	Grey Fox	Threatened
Birds	Acadian Flycatcher	Endangered
	Barn Owl	Endangered
	Cerulean Warbler	Special Concern
	Hooded Warbler	Threatened
	Least Bittern	Threatened
	Peregrine Falcon anatum subspecies	Threatened
	Yellow-breasted Chat virens subspecies	Special Concern
Reptiles & Amphibians	Eastern Ribbonsnake	Special Concern
	Milksnake	Special Concern
	Northern Map Turtle	Special Concern
Lepidopterans	Monarch	Special Concern
Plants, Lichens and Mosses	American Ginseng	Endangered
	Butternut	Endangered
	Swamp Rose-mallow	Special Concern

4.4 SEARCH AND RESCUE STATION PROPERTY FACILITIES

4.4.1 Industrial and Municipal Outfalls

No industrial outfalls were observed adjacent to or within the fenced area of the Port Weller SAR. According to utility locates provided through Ontario One Call, there are no discharges within the area of investigation which was considered to be within 250 m of the Port Weller SAR. Local drainage flows towards Lake Ontario and drainage off the parking lot flows towards the east into the Welland Canal.

4.4.2 On-Site Structures

The on-site structures as observed during the site inspection conducted in September 2008 are presented in Figure 2. The Port Weller SAR has one main dock to the east of the site in the Welland Canal. There is also a boat launch ramp and breakwater to the north of the dock area.

On land structures include an office/residence building (SAR station) situated centrally on the property, an emergency generator room, a small storage shed referred to as the MNR building, a garage, the Ready building, two other small storage sheds, a storage trailer, a wooden boat storage rack and an active Environment Canada Hydrometric Gauging Station.

The original portion of the SAR station building is constructed of painted reinforced concrete with a slab on grade floor and was built in approximately 1931. The addition, completed in 1953 is a wood frame structure with a concrete block basement. The interior is finished. The SAR

station building is multifunctional and is used as the office, residence and workshop for CCG staff. The emergency generator room is attached to the SAR station building and houses backup power generators for the facility.

The building referred to as the MNR building is a small pre-fabricated structure with a metal frame and aluminum siding and sits on a concrete slab. This building was formerly used as an office for the gaming warden but is currently an office and tool storage for the CCG engineer.

The garage is a single storey wood frame structure with exterior aluminum siding and sits on a concrete slab. The garage is used for storage of boating equipment, tools and maintenance supplies for the site including paints, silicone caulking, herbicides and fertilizers.

The Ready building is constructed of precast concrete and sits on a concrete slab. The building is used to store equipment relating to search and rescue operations and refuelling boats including pumps and generators.

The storage sheds and storage trailer are prefabricated structures with exterior aluminum siding or plastic and are used to store equipment for grounds maintenance and recreation including lawnmowers, old wooden doors, bicycles and ATVs.

The Environment Canada Hydrometric Gauging station is a prefabricated metal building that is locked at all times and according to Commanding Officer David McGinnis is periodically entered by Environment Canada staff.

The buildings were found to be in very good condition. All of the buildings are built on concrete slabs and no floor drains were identified.

General maintenance and cleaning products are stored in the garage and are present in consumer sized quantities, in properly labelled containers in very good condition and are located in well ventilated areas. The garages and storage sheds are locked at all times and are very well maintained. No evidence of spills was observed on the day of the site visit by Aqua Terre.

Due to the age of the structures onsite, the following materials which require special handling/disposal practices may be present including:

- Asbestos Containing Materials – asbestos may be present in the window caulking, ceiling tiles, walls, flooring and roofing materials
- Lead Containing Materials – lead may be present in the interior and exterior paint and in solder joints of copper piping within the building
- Mercury – mercury may be present in on-site thermostats
- Polychlorinated Biphenyls – PCBS may be present in fluorescent light ballasts
- Ozone Depleting Substances – the air conditioning units, refrigerator and freezer may contain ODSs
- Other Designated Substances – silica is likely present in the concrete floors, blocks and drywall in the building

A detailed designated substance survey was beyond the Aqua Terre scope of work.

4.4.3 Adjacent Land Uses

The site is located on a breakwater and is surrounded by Lake Ontario to the north and west and the Welland Canal to the east.

4.4.4 Fuel Dispensing, Underground and Aboveground Storage Tanks

Six (6) ASTs are located on site (Figure 2). Photographs of the ASTs are included in Appendix D. Each of these tanks is included in the DFO Tank Registry forwarded from PWGSC and appear to be current. The landowner for all tanks is listed as the SLSMC and the operator as DFO-CCG. The ASTs include:

- 1-1,100L heating oil (for heating the main SAR building, photos 10 and 21)
- 1-910L diesel fuel (for use in the emergency generator, photo 7)
- 1-935L heating oil (for heating the emergency generator building, photos 6 and 7)
- 1-11,000L diesel fuel (for CCG boats, police boats and scientific vessels, photos 8 and 9)
- 1-1,900L gasoline (for on site land vehicles, photos 13 and 20), and
- 1-500L waste oil (photo 13).

General tank specifications (CH2M Hill, 2003) include:

Volume	Installation Date	Tank Construction	Secondary Containment
1,000 L heating oil	1997 (?)	single wall	no
910 L diesel	1996 (?)	single wall	no
935 L heating oil	2000 (?)	single wall	no
11,000 L diesel	1991 (?)	single wall steel tank	yes
1,900 L gasoline	1993 (?)	double wall steel tank	yes
500 L waste oil	1991 (?)	double wall steel tank	yes

A fuel dispensing station is located at the Ready building adjacent to the dock and is supplied by underground piping from the 11,000 L AST.

The ASTs were inspected in 2003 (CH2M Hill 2003). Items that were out of compliance were identified as well as suggestions for Best Management practices. Repairs were reportedly made based on the findings of the CH2M Hill report. New underground fuel delivery piping from the 11,000 L diesel tank was installed in December, 2004 (PWGSC, 2004).

Based on visual inspection during the site visit by Aqua Terre, the tanks were generally in good condition and there was no evidence of staining in the vicinity of the tanks. Tank inspection checklists are provided in Appendix E.

4.4.5 Other Tanks

The CCG Commanding Officer indicated that two underground septic tanks are located on site to the east of the SAR building and are used to store sewage from this building. The Commanding Officer could not confirm who owns these tanks. These tanks are pumped out annually in the spring. The Commanding Officer noted that a visual high level alarm for the tanks is present. No report was available concerning installation of these tanks.

4.4.6 Water Supply

The potable water supply for the SAR is an on site drilled potable water supply well. The CCG Commanding Officer was not certain who owned this well, nor was any information available from MOE water well records obtained through EcoLog Eris. The Commanding Officer could not confirm who owns the well. The well is located to the west of the SAR building. Well water is treated with a chlorinator, carbon filter, cartridge filter, ultraviolet system, water conditioner and a reverse osmosis system.

According to the CCG Commanding Officer, the well is sampled monthly for total coliforms and quarterly by Health Canada for chlorine, fluorine, nitrate, nitrite, pH, sulphate and total dissolved solids. Potable water samples are reportedly taken from the kitchen faucet in order to represent treated water that is ingested by users of the SAR building. The CCG Commanding Officer was not aware of any reports concerning adverse water quality results

The EcoLog ERIS report did not identify the water well on-site or any others within a 0.25km radius of the site.

A “surface water well” located in the dock area draws water from the Welland Canal for boat washing and general lawn water. This “well” is owned by DFO and consists of a PCV casing attached to one of the docks (Appendix D, Photograph 19). The casing serves as a protective housing for a submersible pump that draws water from the canal. The well is installed each spring and removed each fall.

4.4.7 Chronology of Dredging and Disposal

There were no records available from PWGSC regarding dredging adjacent to the Port Weller SAR station. The CCG Commanding Officer was not aware of any dredging activities in the vicinity of the site.

4.4.8 Spills

The CCG Commanding Officer was not aware of any spills on site. No spill records were identified in the EcoLog ERIS database search. There was no visual evidence of spills on site or in the water adjacent to the site during the site visit by Aqua Terre.

4.5 SUMMARY OF SIGNIFICANT PHASE I ESA FINDINGS

The potential environmental concerns (PACs) identified in the Phase I ESA and carried forward by Aqua Terre for the Phase II ESA at this site include the following:

- PAC-1: Six ASTs are present on site. Soil and groundwater quality in the vicinity of these ASTs is unknown and should be evaluated. Potential contaminants of concern (PCOCs) include PHC (petroleum hydrocarbon compounds) and BTEX (benzene, toluene, ethylbenzene and xylenes) from potential tank leakages.
- PAC-2: The quality of fill used to construct the breakwater is unknown. Fill quality should be evaluated in conjunction with PAC-1; metals are considered a generally representative PCOC to characterize imported fill.
- PAC-3: The quality of sediments adjacent to the site is unknown and should be evaluated. PCOCS include metals and PHC, if warranted.

Areas representing PAC-1, PAC-2 and PAC-3 are shown in Figure 3.

5 PHASE II ENVIRONMENTAL SITE ASSESSMENT

5.1 GENERIC STANDARDS

SLSMC operates seaway facilities on behalf of the federal government in accordance with federal regulations. As such, the Port Weller SAR property is considered federal land. Therefore, Canadian Council of Ministers of the Environment (CCME) guidelines are considered applicable for assessing soil and groundwater quality on site.

5.1.1 Soil Quality Guidelines

The selected CCME guidelines for soil quality are the *Canadian Environmental Quality Guidelines, Chapter 7 - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Residential/Parkland land use, fine-grained soil texture* (CCME, 1999, updated 2007). The selected guidelines for petroleum hydrocarbons are the *CCME Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Tier 1 levels for PHCs for fine-grained surface soils, Residential/Parkland land use* (CCME, 2001).

The on-site land use is considered residential/parkland since the facilities on-site include a residence and vegetable gardens. The CCME guideline for benzene was chosen based on an incremental lifetime cancer risk of 10^{-6}. Selection of soil texture was based on laboratory sieve analysis of soil samples (Section 5.4.1)

- The property land use at the site is residential/parkland/institutional and it is projected to remain as such; and
- Based on unconsolidated soil and fill encountered during borehole drilling, site soils have been classified as fine textured (at least 2/3 of the soil at the property, measured by volume, consists of soil that contains more than 50 percent by mass of particles that are less than 75 µm in mean diameter)(borehole logs are provided in Appendix F).

5.1.2 Water Quality Guidelines

The Canadian Water Quality Guidelines were used to assess water quality from the on site potable water supply well.

5.2 SITE INVESTIGATION

The site investigation was completed by Aqua Terre on September 15 and 26, 2008.

5.2.1 Methodology

Soil Sampling

Borehole drilling and soil sampling were completed on September 26, 2008. Eight (8) boreholes (BH-101, BH-102, BH-103, BH-104, BH-105, BH-106, BH-107 and BH-108) were completed with the combined objective of evaluating potential environmental impacts from ASTs and general fill quality. Since the entire site is underlain with fill, no specific background samples were collected.

Drilling was completed by Geo-Environmental Drilling, using portable Pionjar drilling equipment equipped with split spoon samplers. The boreholes were located in the vicinity of the ASTs around the site (Figure 4). The split spoon sampler was advanced in 0.15 m segments at which time the spoon was withdrawn and sample recovered. All boreholes were advanced until refusal from 1.2 to 2.1 m below ground surface (bgs).

Samples were collected at 0.15 m intervals and logged for soil type and visual evidence of contamination. Soil samples were screened using a Gastech ME1238 organic vapour meter (OVM). The OVM was operated in methane elimination mode and calibrated with a known hexane standard. Samples were placed in laboratory-supplied containers. The sample from each borehole with the highest OVM was submitted for laboratory analyses. A total of eight (8) borehole soil samples were submitted for laboratory analyses of one or more of benzene, toluene, ethylbenzene and xylenes (BTEX), and petroleum hydrocarbon fractions (PHC F1 to F4), inorganics, PAHs, pH and grain size.

Soil sample analytical results are discussed in Section 5.3.1.

Potable Water Sampling

A potable water sample was collected from the kitchen tap in the SAR building. This sampling location was chosen since it represents the treated water that is ingested by users of the SAR building. The water was run for approximately 10 minutes. The sample was collected in laboratory supplied bottles and submitted for laboratory analysis of inorganics.

Sediment Sampling

Aqua Terre attempted to sample sediment in the Welland Canal to the east of the site on September 26, 2008. Numerous attempts were made around each of the docks and at several locations up to 50 m from shore. Sampling was attempted at approximately 20 locations. No geo reference of locations was conducted since no samples were collected. The CCG provided

and operated a boat to conduct this sampling. Aqua Terre attempted to collect sediment at numerous locations using a Ponar sampler. However, there was insufficient sediment to sample.

5.2.2 Laboratory Analysis

Soil and water samples were analysed by Maxxam Analytics Inc of Mississauga. It is a CAEAL (Canadian Association of Environmental Analytical Laboratories) certified commercial laboratory to perform soil and water analyses requested during this assessment.

5.2.3 Quality Assurance/Quality Control (QA/QC)

A quality assurance and quality control (QA/QC) program was implemented to address the office and field programs. All project documentation was maintained and controlled under a specific site file with a unique site file identifier.

As a minimum, sampling equipment was decontaminated using a phosphate-free detergent and clean water before collecting subsequent samples to reduce the risk of cross-contamination between samples. For all sampling locations, logs containing all pertinent information were prepared and collected samples were placed in appropriate containers immediately upon retrieval. Field sampling and equipment decontamination was completed in accordance with applicable provincial (MOEE, 1996) and federal (CCME, 1994) protocols and applicable industry practices. All laboratory chemical analyses were performed by an analytical laboratory accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL).

A QA/QC co-ordinator was assigned to the project to ensure that all samples had the proper field identification and sample location. The QA/QC co-ordinator also completed the chain of custody forms, releasing selected samples to the laboratory for analysis. A chain of custody form accompanied the samples at all points of handling.

Field QA/QC samples were not submitted from the borehole soil samples due to limited sample recovery. After preparing samples for the required analyses, there was insufficient soil to prepare field duplicate QA/QC samples. Laboratory QA/QC samples included the use of duplicates, blanks and spiked samples.

5.3 RESULTS

5.3.1 Soils

Soils encountered in the boreholes generally consisted of silty or clayey fill. Detailed soil sample descriptions and OVM readings are provided in borehole logs in Appendix F. The water table was not encountered in any of the boreholes.

Analytical results for soil samples and available CCME criteria are presented in Table 1 (BTEX and PHC), Table 2 (inorganics), Table 3 (PAHs) and Table 4 (pH and grain size). Laboratory

certificates of analysis for soil analytical data (including pH and grain size) are provided in Appendix G.

5.3.2 Potable Water

Analytical results for the potable water sample collected and available CCME criteria are presented in Table 5. Laboratory certificates of analysis are provided in Appendix H.

5.3.3 Quality Assurance / Quality Control

Field QA/QC samples were not submitted from the borehole soil samples due to limited sample recovery. Laboratory QA/QC analyses (included in the certificates of analysis) are within acceptable limits and suggest that laboratory and field handling protocols were acceptable.

5.4 DISCUSSION

5.4.1 Soils

Soil pH measured in samples from boreholes 101 and 102 ranged from 7.7 to 7.8. The sample submitted for grain size analysis from borehole 102 was determined to be "fine grained" since over 90% of the sample particles were less than 0.075 mm.

Concentrations of PHC F1 to F4 and PAHs, where analysed, were reported to be below laboratory detection limits. PHC F1 - F4 concentrations in soil samples submitted from boreholes BH-1, BH-2, BH-4 and BH-5 were reported to be below laboratory detection limits.

BTEX concentrations in soil samples from boreholes BH-101, BH-102, BH-103, BH-104, BH-105, BH-106, BH-107 and BH-108 were reported at concentrations which satisfied the applicable CCME guidelines.

Inorganic parameters analysed in soil samples from boreholes BH-101, BH-103, BH-104, BH-106, BH-107 and BH-108 were reported at concentrations which satisfied the applicable CCME guidelines. Borehole soil samples therefore satisfy the applicable CCME criteria.

BTEX and PHC apparently occur in only minimal concentrations or less than reported detection limits in soils. It was not possible to extend boreholes below the water table to install shallow monitoring wells to assess potential groundwater quality effects from potentially undetected PHC releases from the ASTs on site.

5.4.2 Potable Water

Inorganic parameters analysed in the potable water sample was reported at concentrations which satisfied the applicable CCME guidelines with the exception of the aesthetic objective for sodium.

5.5 SUMMARY OF SIGNIFICANT PHASE II ESA FINDINGS

The main findings of the Phase II ESA are summarized as follows:

- PAC-1: Boreholes were installed to assess soil quality on site and as close as practical to ASTs. No PHC soil impacts were encountered. It is concluded that the tanks have little subsurface impacts, if any.
- PAC-2: Shallow soil sampling of fill underlying the site was conducted in conjunction with soil sampling around the ASTs. No poor quality fill was encountered and it is concluded that fill quality is not a concern.
- PAC-3: Sediment sampling was attempted. However, there was insufficient sediment to sample and it is concluded that sediment quality is not a concern.

6 SUMMARY

6.1 SUMMARY

A Phase I/II ESA was completed at the Port Weller Canadian Coast Guard (CCG) Search and Rescue Station (SAR) located on the south shores of Lake Ontario, west of the entrance to the Welland Canal. The SAR site covers an area of approximately 1400 m^2. The site is owned by the St. Lawrence Seaway Management Corporation (SLSMC), is leased by the Department of Fisheries and Oceans (DFO) and operated by the Canadian Coast Guard. Infrastructure at the site includes: a boat launch ramp and breakwater, floating docks, a residence/office building, MNR building, six garage/storage buildings, an Environment Canada Hydrometric Gauging Station and fuel pumping facilities.

Fuel facilities include six (6) aboveground storage tanks (one aboveground gasoline storage tank, one aboveground waste oil storage tank, two aboveground fuel oil storage tanks, two aboveground diesel storage tanks, one of which has associated piping/dispenser for vessels). Sewage facilities include two underground septic holding tanks and septic leaching bed. These fuel and sewage facilities are operated by the Canadian Coast Guard.

The potential environmental concerns (PACs) identified in the Phase I ESA and carried forward to the Phase II ESA, are summarized as follows:

- PAC-1: Six ASTs are present on site. Soil and groundwater quality in the vicinity of these ASTs is unknown and should be evaluated.
- PAC-2: The quality of fill used to construct the breakwater is unknown. Fill quality should be evaluated in conjunction with PAC-1,
- PAC-3: The quality of sediments adjacent to the site is unknown and should be evaluated.

Phase II soil sampling was conducted with Pionjar drilling equipment in the vicinity of the ASTs. Soil samples were submitted for laboratory analyses of one or more of benzene, toluene, ethylbenzene and xylenes (BTEX), and petroleum hydrocarbon fractions (PHC F1 to F4), inorganics, PAHs, pH and grain size. One sample was collected from the potable water supply well at the SAR. An attempt was made to collect sediment samples with a Ponar sampler in the Welland Canal but there was insufficient sediment to sample.

The main findings of the Phase II ESA are summarized as follows:

- PAC-1: Boreholes were installed to assess soil quality on site and as close as practical to ASTs. No PHC soil impacts were encountered. It is concluded that the tanks have little subsurface impacts, if any.
- PAC-2: Shallow soil sampling of fill underlying the site was conducted in conjunction with soil sampling around the ASTs. No poor quality fill was encountered and it is concluded that fill quality is not a concern.
- PAC-3: Sediment sampling was attempted. However, there was insufficient sediment to sample and it is concluded that sediment quality is not a concern.

- Water sampled from the potable water supply well met Canadian Drinking Water Quality Guidelines except for sodium which is an aesthetic parameter.

7 RECOMMENDATIONS

The following recommendations are provided for consideration:

a) Visual inspections of the ASTs should be conducted on a regular basis.
b) A Designated Substance Survey should be completed prior to any future construction or demolition on site.

8 QUALIFICATIONS OF ASSESSMENT TEAM

Project management and report preparation was conducted by Thom Kewen, M.S, P.Geo. He has over 25 years experience in contaminant hydrogeology and environmental management and is a "Qualified Person" under Ontario Regulation 153/04. He has conducted a wide range of Phase I, II and II assessments at a wide range of properties in Ontario. Background research, site observations, site interview and field sampling activities were conducted by Allison McIntosh, B.Sc., Dipl. Env. Eng. She has over 5 years experience in environmental assessment of soil, groundwater and surface water and has conducted a wide variety of Phase I, II and III assessments throughout Ontario.

9 REFERENCES

Canadian Council of Ministers of the Environment (CCME), 2008. National Classification System for Contaminated Sites.

Canadian Council of Ministers of the Environment (CCME), 1994. Subsurface Assessment Handbook for Contaminated Sites, Report CCME EPC-NCSRP-48E. March 1994.

Canadian Council of Ministers of the Environment (CCME), 1999. Canadian Environmental Quality Guidelines, Chapter 6 – Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, as updated. Chapter 7 – Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, as updated.

Canadian Council of Ministers of the Environment (CCME), 2001. Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, as updated.

Canadian Standards Association (CSA), 2001. CSA Standard Z768-01, Phase I Environmental Site Assessment. November 2001.

Health Canada, 2008. Summary of Guidelines for Canadian Drinking Water Quality. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Environmental and Occupational Health. May 2008.

Ontario Ministry of the Environment (MOE), 1993a. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. August 1993.

Ontario Ministry of the Environment (MOE), 2004. Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act, Ontario Regulation 153/04 (amended to O.Reg. 366/05). March 9, 2004.

Ontario Ministry of the Environment and Energy (MOEE), 1996. Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario. 1996.

Ontario Ministry of Northern Development and Mines (MNDM), 1991a. Bedrock Geology of Ontario, Southern Sheet, Map 2544.

Ontario Ministry of Northern Development and Mines (MNDM), 1991b. Quaternary Geology of Ontario, Southern Sheet, Map 2556.

Treasury Board of Canada, 2002. Policy on Accounting for Costs and Liabilities Related to Contaminated Sites. April 2002. Updated June 2003.

10 USE AND LIMITATIONS OF THIS PHASE I/II ESA REPORT

The statements made in this report are based solely on the information obtained to date as part of the above referenced study. Aqua Terre Solutions Inc. (Aqua Terre) has used its professional judgement in assessing this information and formulating its opinion and recommendations. New information may result in a change in this opinion. The mandate at Aqua Terre is to perform the tasks prescribed by the Client with the due diligence of the profession. No other warranty or representation, expressed or implied, as to the accuracy of the information or recommendations is included or intended in this report. The results of this study should in no way be construed as a warranty that the subject property is free from any and all contamination.

Aqua Terre disclaims any liability or responsibility to any person or party, other than the party to whom this report is addressed, for any loss, damage, expense, fine, or penalty which may arise or result from the use of any information or recommendations contained in this report. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the sole responsibility of the third party.

Respectfully Submitted,
Aqua Terre Solutions Inc.

Allison MacIntosh, B.Sc., Dipl. Env. Eng.
Environmental Scientist

Thom Kewen, M.Sc., P.Geo.
Senior Hydrogeologist

PROFESSIONAL GEOSCIENTIST
THOMAS J. KEWEN
PRACTISING MEMBER
0564
ONTARIO
Feb 11/09

Tables

TABLE 1 SOIL ANALYTICAL RESULTS - BTEX/PHCs
Port Weller Search and Rescue

Aqua Terre Sample No. Parameter	RDL	Units	CCME Criteria Com. [1]	CCME Criteria Res./Park. [2]	BH-101-2	BH-102-2	BH-103-1	BH-104-2	BH-105-1	BH-106-1	BH-107-3	BH-108-1
Sampling Date	na	na	na	na	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08
Borehole No.	na	na	na	na	*BH-101*	*BH-102*	*BH-103*	*BH-104*	*BH-105*	*BH-106*	*BH-107*	*BH-108*
Benzene	0.002	µg/g	0.0068	0.0068	0.003	<	0.005	0.003	0.004	0.009	0.005	0.004
Toluene	0.002	µg/g	0.08	0.08	0.004	0.002	0.008	0.008	0.008	0.007	0.008	0.007
Ethylbenzene	0.002	µg/g	0.018	0.018	<	<	<	<	<	<	<	<
m,p-Xylenes	0.002	µg/g	ng	ng	<	<	0.008	0.005	0.005	0.003	0.006	0.004
o-Xylene	0.002	µg/g	ng	ng	<	<	<	<	<	<	<	<
Xylenes	0.002	µg/g	2.4	2.4	<	<	0.008	0.005	0.005	0.003	0.006	0.004
Petroleum Hydrocarbons												
PHC F1	10	µg/g	320 [3]	210 [3]	<	<	<	<	<	<	<	<
PHC F2	10	µg/g	260 [3]	150 [3]	<	<	<	<	<	<	<	<
PHC F3	10	µg/g	2500 [3]	1300 [3]	<	<	<	<	<	<	<	<
PHC F4	10	µg/g	6600 [3]	5600 [3]	<	<	<	<	<	<	<	<

RDL	reportable detection limit
na	not applicable
ng	no guideline
<	less than RDL
[1]	Table 1: Commercial land use, fine textured soils, Canadian Environmental Quality Guidelines, (CCME 1999 as updated)
[2]	Table 1: Residential/Parkland land use, fine textured soils, Canadian Environmental Quality Guidelines, (CCME 1999 as updated)
[3]	Table 1: Summary of Tier 1 Levels for surface soil, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME 2001, as updated)
BOLD	Exceed CCME Commercial soil guideline
Underline	Exceed CCME Residential/Parkland soil guideline

TABLE 2 **SOIL ANALYTICAL RESULTS - INORGANICS**
Port Weller Search and Rescue

Aqua Terre Sample No. / Parameter	RDL	Units	CCME Criteria Com. [1]	CCME Criteria Res./Park. [2]	BH-101-2	BH-102-2	BH-103-1	BH-104-2	BH-105-1	BH-106-1	BH-107-3	BH-108-1
Sampling Date	na	na	na	na	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08	26-Sep-08
Borehole No.	na	na	na	na	*BH-101*	*BH-102*	*BH-103*	*BH-104*	*BH-105*	*BH-106*	*BH-107*	*BH-108*
Antimony	0.2	µg/g	40*	20*	<	-	<	<	-	<	<	0.2
Arsenic	1	µg/g	12	12	10	-	5	5	-	3	4	7
Barium	0.5	µg/g	2000	500	25	-	100	98	-	52	130	63
Beryllium	0.2	µg/g	8*	4*	0.7	-	0.5	0.6	-	0.4	0.6	0.5
Boron (soluble)	0.01	µg/g	ng	ng	0.12	-	0.12	0.07	-	0.27	0.23	0.31
Cadmium	0.1	µg/g	22	10	<	-	<	<	-	0.1	0.1	0.2
Chromium (total)	1	µg/g	87	64	15	-	17	18	-	13	21	18
Chromium (VI)	0.2	µg/g	1.4	0.4	<	-	<	<	-	<1	<	<1
Cobalt	0.1	µg/g	300*	50*	13	-	9.4	11	-	6.8	11	10
Copper	0.5	µg/g	91	63	33	-	28	27	-	20	25	24
Lead	1	µg/g	260	140	17	-	7	7	-	12	11	62
Mercury	0.05	µg/g	24	6.6	0.19	-	<	<	-	1.4	<	0.16
Molybdenum	0.5	µg/g	40*	10*	0.6	-	<	<	-	<	0.5	<
Nickel	0.5	µg/g	50	50	25	-	21	22	-	15	25	21
Selenium	0.5	µg/g	2.9	1	<	-	<	<	-	0.6	<	<
Silver	0.2	µg/g	40*	20	<	-	<	<	-	<	<	<
Thallium	0.05	µg/g	1	1	0.11	-	0.07	0.08	-	0.05	0.09	0.09
Vanadium	5	µg/g	130	130	16	-	25	26	-	15	27	19
Zinc	5	µg/g	360	200	61	-	49	51	-	39	63	110

RDL	reportable detection limit
na	not applicable
ng	no guideline
<	less than RDL
-	not analysed
<###	adjusted DL (###) exceeds soil site condition standard
[1]	Table 1: Soil Quality Guidelines for Carcinogenic and Other PAHs, Soil quality guidelines for environmental health, Commercial Land Use, Canadian Environmental Quality Guidelines, (CCME 1999 as updated)
[2]	Table 1: Soil Quality Guidelines for Carcinogenic and Other PAHs, Soil quality guidelines for environmental health, Residential/Parkland Land Use, Canadian Environmental Quality Guidelines, (CCME 1999 as updated)
*	Table 2: Interim remediation criterial for soil, coarse textured soils, Canadian Environmental Quality Guidelines, Interim remediation criteria (CCME 1999 as updated)
BOLD	Exceed CCME Commercial soil guideline
Underline	Exceed CCME Residential/Parkland soil guideline

TABLE 3 SOIL ANALYTICAL RESULTS - PAHs
Port Weller Search and Rescue

Aqua Terre Sample No. / Parameter	RDL	Units	CCME Com. SQG_E [1]	CCME Res./Park. SQG_E [2]	BH-104-2
Sampling Date	na	na	na	na	26-Sep-08
Borehole No.	na	na	na	na	*BH-104*
Acenaphthene	0.01	µg/g	ng	ng	<
Acenaphthylene	0.005	µg/g	ng	ng	<
Anthracene	0.005	µg/g	32	2.5	<
Benzo(a)anthracene	0.01	µg/g	ng	ng	<
Benzo(a)pyrene	0.005	µg/g	72	20	<
Benzo(b/j)fluoranthene	0.01	µg/g	ng	ng	<
Benzo(g,h,i)perylene	0.02	µg/g	ng	ng	<
Benzo(k)fluoranthene	0.01	µg/g	ng	ng	<
Chrysene	0.01	µg/g	ng	ng	<
Dibenzo(a,h)anthracene	0.02	µg/g	ng	ng	<
Fluoranthene	0.005	µg/g	50	180	<
Fluorene	0.005	µg/g	ng	ng	<
Indeno(1,2,3-cd)pyrene	0.02	µg/g	ng	ng	<
1-Methylnaphthalene	0.005	µg/g	ng	ng	<
2-Methylnaphthalene	0.005	µg/g	ng	ng	<
Naphthalene	0.005	µg/g	ng	ng	<
Phenanthrene	0.005	µg/g	ng	ng	<
Pyrene	0.005	µg/g	ng	ng	<

RDL	reportable detection limit
na	not applicable
ng	no guideline
<	less than RDL
[1]	Table 1: Soil Quality Guidelines for Carcinogenic and Other PAHs, Soil quality guidelines for environmental health, Commercial Land Use, Canadian Environmental Quality Guidelines, (CCME 1999 as updated)
[2]	Table 1: Soil Quality Guidelines for Carcinogenic and Other PAHs, Soil quality guidelines for environmental health, Residential/Parkland Land Use, Canadian Environmental Quality Guidelines, (CCME 1999 as updated)
BOLD	Exceed CCME Commercial soil guideline
Underline	Exceed CCME Residential/Parkland soil guideline

TABLE 4 **SUMMARY of pH and GRAIN SIZE ANALYTICAL RESULTS**
Port Weller Search and Rescue

Aqua Terre Sample No.	**Units**	**CCME Criteria Criteria [1]**	**BH-101-2**	**BH-102-2**
Laboratory Sample No.	na	na	AP7356	AP7357
Sampling Date	na	na	*26-Sep-08*	*26-Sep-08*
Sample Location	na	na	*BH-101*	*BH-102*
pH	na	5.0-9.0 *	7.78	7.66
Particles >75um	%	50		8.2
Corresponding Soil Texture	na	nc		fine

na not applicable
nc no criterion
[1] Table 1: Summary of Tier 1 Levels for surface soil, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME 2001, as updated)
* pH = 5.0-9.0 for sample depth < 1.5 m and pH = 5-11 for samples collected at depths >1.5m.

TABLE 5 POTABLEWATER ANALYTICAL RESULTS - INORGANICS
Port Weller Search and Rescue

Aqua Terre Sample No. Parameter	RDL	Units	CCME Criteria	PWSAR-SEPTEMBER 2008
Sampling Date	na	na	na	26-Sep-08
Aluminum	5	µg/L	ng	5
Antimony	0.5	µg/L	6 [2]	<
Arsenic	1	µg/L	10 [2]	<
Barium	5	µg/L	1000 [1]	<
Beryllium	0.5	µg/L	ng	<
Boron	10	µg/L	5000 [2]	1300
Cadmium	0.1	µg/L	5 [1]	<
Calcium	200	µg/L	ng	1900
Chromium (total)	5	µg/L	50 [1]	<
Cobalt	0.5	µg/L	ng	<
Copper	1	µg/L	≤1000 [3]	11
Iron	100	µg/L	≤300 [3]	<
Lead	0.5	µg/L	10 [1]	<
Magnesium	50	µg/L	ng	680
Manganese	2	µg/L	≤50 [3]	<
Molybdenum	1	µg/L	ng	13
Nickel	1	µg/L	ng	<
Phosphorus	100	µg/L	ng	<
Potassium	200	µg/L	ng	12000
Selenium	2	µg/L	10 [1]	<
Silicon	50	µg/L	ng	4900
Silver	0.1	µg/L	ng	<
Sodium	1000	µg/L	≤200,000 [3]	**410000**
Strontium	1	µg/L	ng	89
Thallium	0.05	µg/L	ng	<
Titanium	5	µg/L	ng	<
Uranium	0.1	µg/L	20 [2]	0.2
Vanadium	1	µg/L	ng	<
Zinc	5	µg/L	≤5000 [3]	12

RDL reportable detection limit
na not applicable
ng no guideline
< less than RDL
[1] Guidelines for Canadian Drinking Water Quality based on maximum acceptable concentration, Canadian Environmental Quality Guidelines (CCME, 2008)
[2] Guidelines for Canadian Drinking Water Quality based on interim maximum acceptable concentration, Canadian Environmental Quality Guidelines (CCME, 2008)
[3] Guidelines for Canadian Drinking Water Quality based on aesthetic objectives, Canadian Environmental Quality Guidelines (CCME, 2008)
BOLD Exceed CCME drinking water quality guideline

Figures

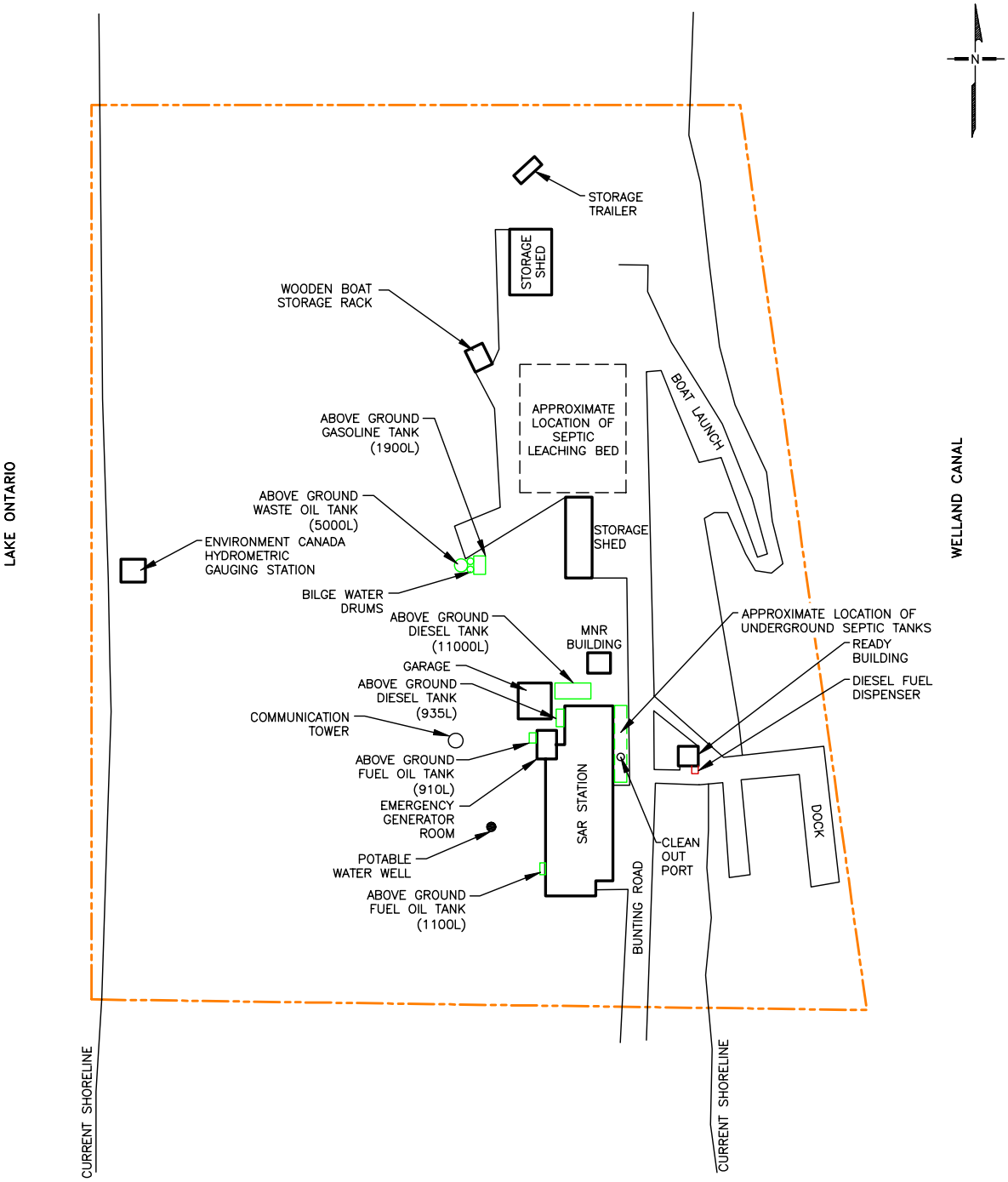
SOURCE: SCHWERDT GRAPHIC ARTS LTD., (MapArt), 2007 EDITION

SCALE 1:25,000

0 0.5 1km

AQUA TERRE

Client/Location: PUBLIC WORKS PORT WELLER SEARCH AND RESCUE STATION, ST. CATHARINES, ON		Title: SITE LOCATION PLAN	
Project No: 08228D	Filename: 01F01_08228D	Date: OCTOBER 2008	Drawing No: FIGURE 1
Drawn: FD	Verified:	Project Manager:	



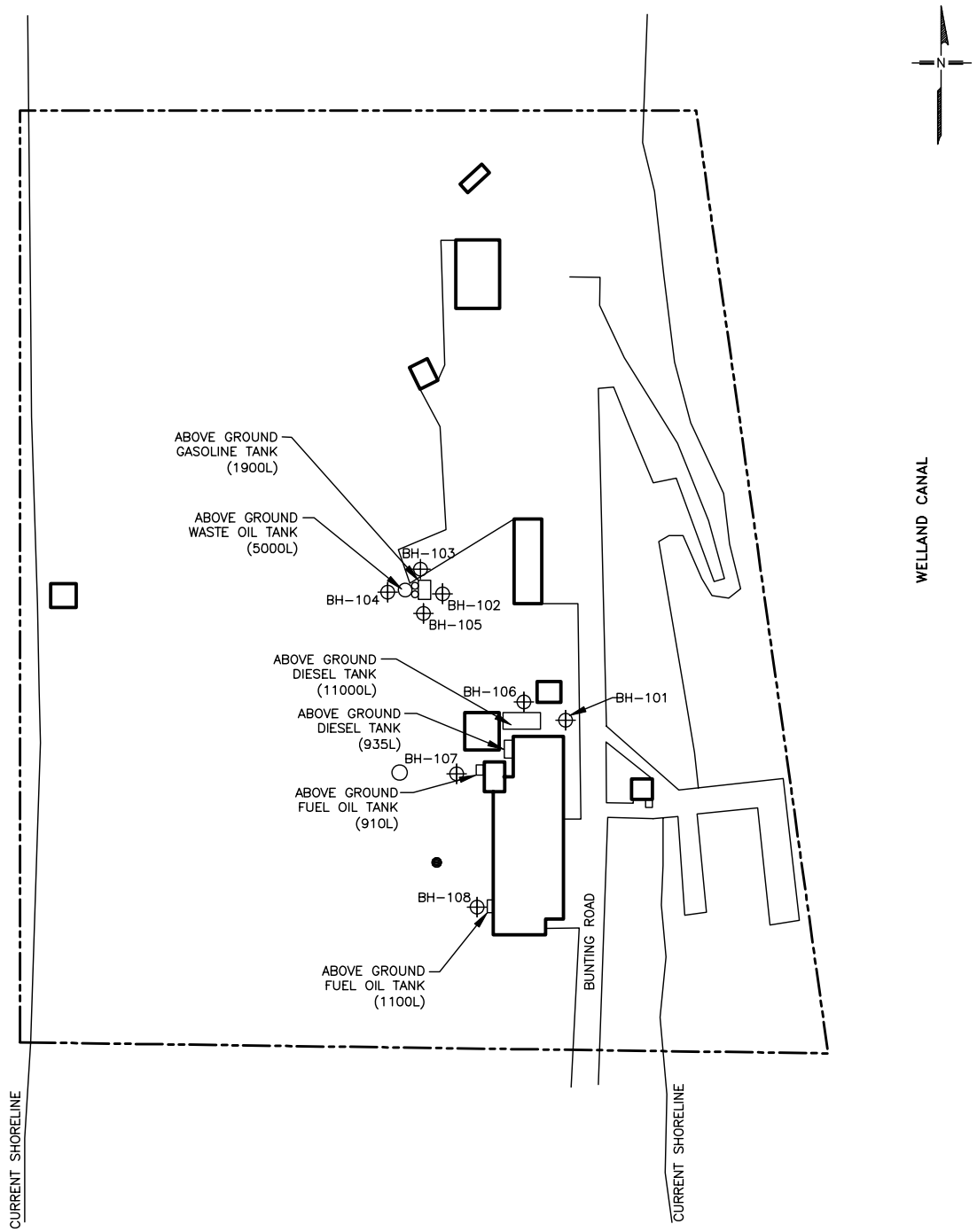
LEGEND

- AREA OF INVESTIGATION AND ASSUMED AREA OF LEASE
- EXISTING BUILDING
- INFRASTRUCTURE
- ABOVE GROUND TANK
- UNDERGROUND TANK

NOTE(S):
1. THIS FIGURE IS NOT TO SCALE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PHOTOCOPIED OR FAXED

AQUA TERRE

Client/Location: PUBLIC WORKS PORT WELLER SEARCH AND RESCUE STATION ST. CATHARINES, ON		Title: SITE LAYOUT	
Project No: 08228D	Filename: 01F02_08228D	Date: OCTOBER 2008	Drawing No: FIGURE 2
Drawn: AG/FD	Verified:	Project Manager:	



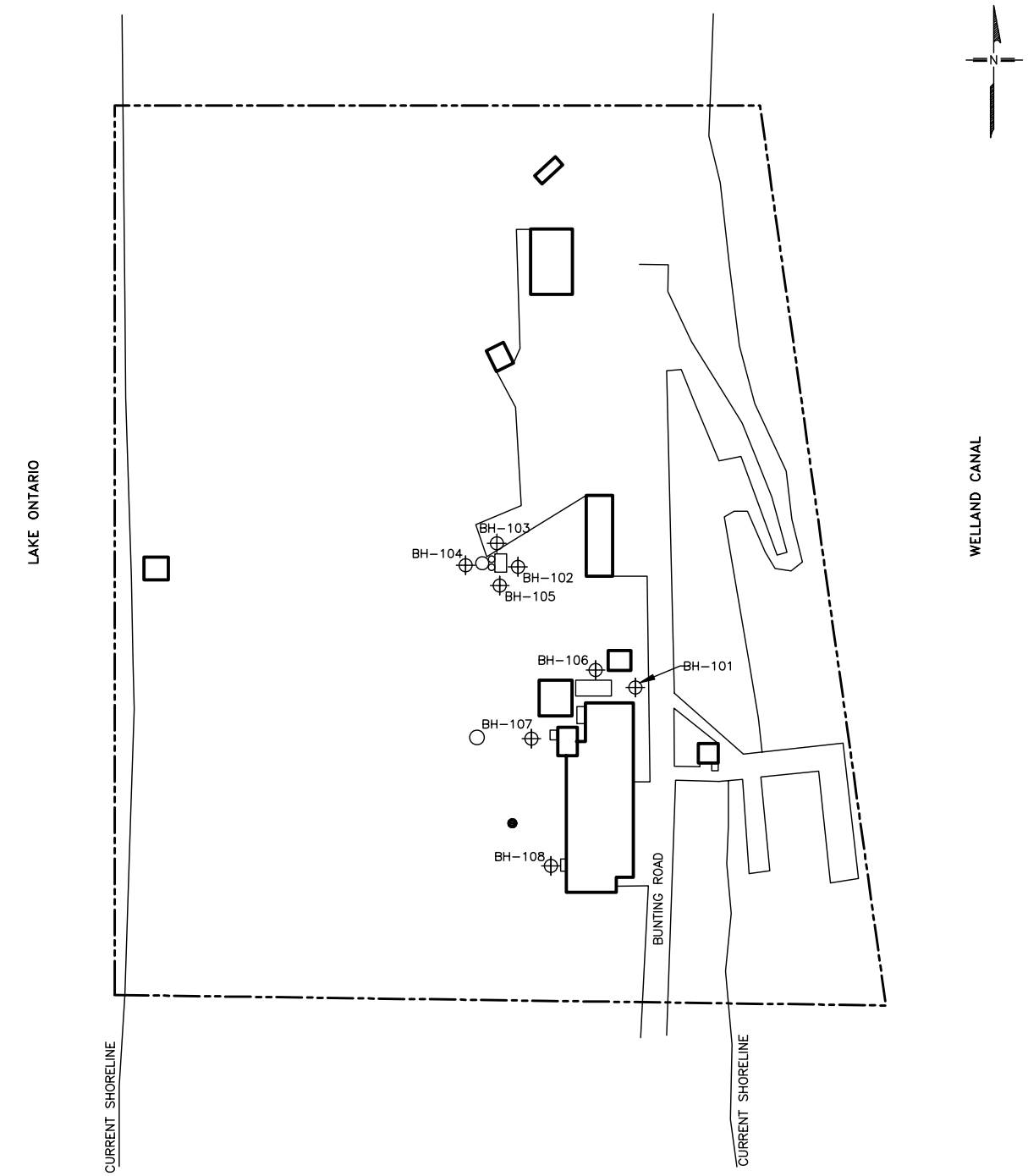
LEGEND

- AREA OF INVESTIGATION AND ASSUMED AREA OF LEASE
- EXISTING BUILDING
- INFRASTRUCTURE
- ABOVE GROUND TANK

NOTE(S):
1. THIS FIGURE IS NOT TO SCALE
2. PAC-1: ALL ABOVE GROUND STORAGE TANKS (AS SHOWN)
3. PAC-2: FILL OF UNKNOWN QUALITY THAT UNDERLIES THE ENTIRE AREA OF INVESTIGATION

AQUA TERRE

Client/Location: PUBLIC WORKS PORT WELLER SEARCH AND RESCUE STATION ST. CATHARINES, ON		Title: POTENTIAL AREAS OF CONCERN IDENTIFIED FROM PHASE I	
Project No: 08228D	Filename: 01F03_08228D	Date: JANUARY 2009	Drawing No: FIGURE 3
Drawn: AG	Verified:	Project Manager:	



LEGEND

- BOREHOLE
- AREA OF INVESTIGATION AND ASSUMED AREA OF LEASE
- EXISTING BUILDING
- INFRASTRUCTURE

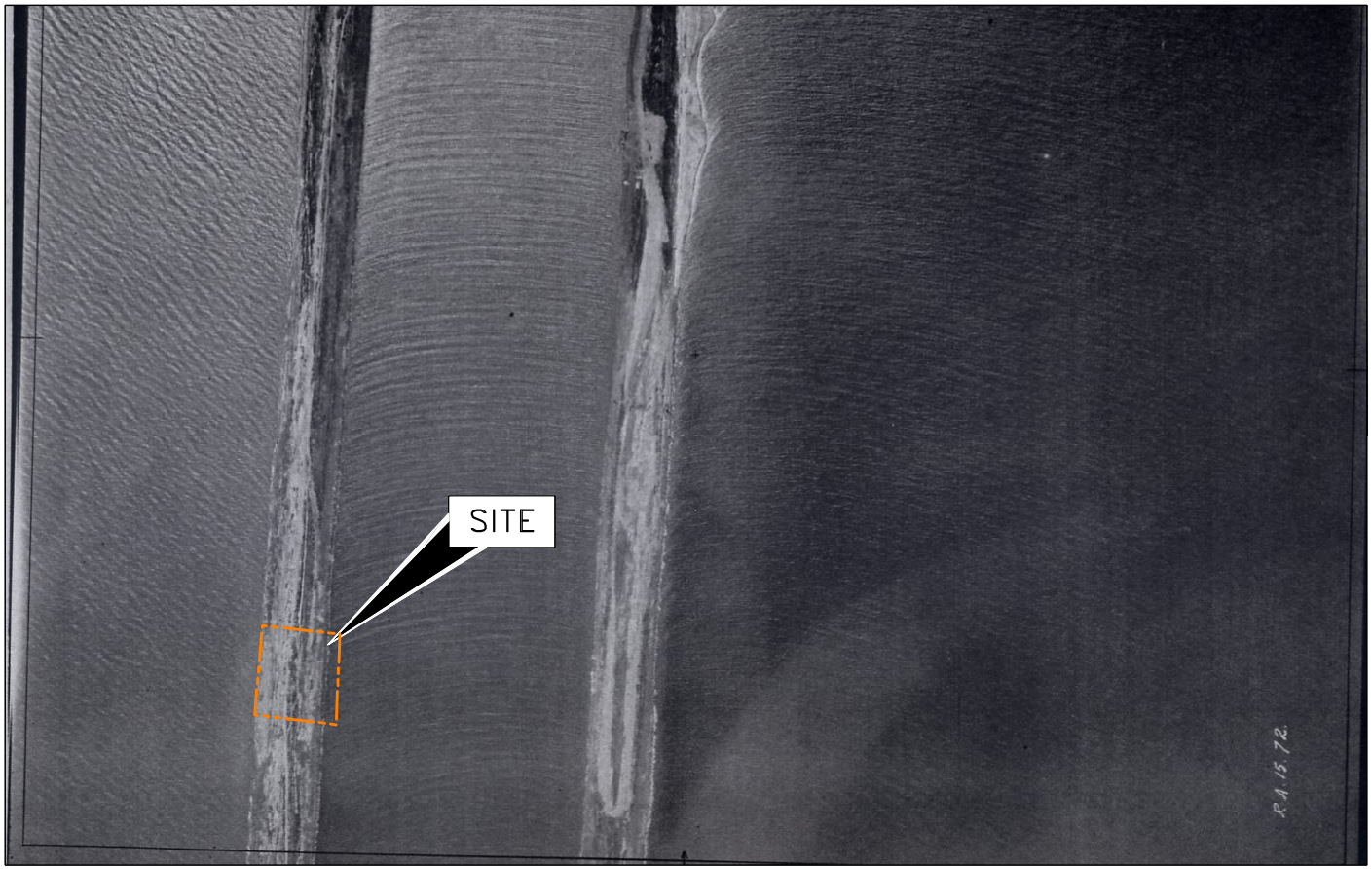
NOTE(S):
1. THIS FIGURE IS NOT TO SCALE

AQUA TERRE

Client/Location: PUBLIC WORKS PORT WELLER SEARCH AND RESCUE STATION ST. CATHARINES, ON		Title: BOREHOLE LOCATION PLAN	
Project No: 08228D	Filename: 01F04_08228D	Date: OCTOBER 2008	Drawing No: FIGURE 4
Drawn: AG/FD	Verified:	Project Manager:	

Appendix A

Selected Aerial Photographs



N

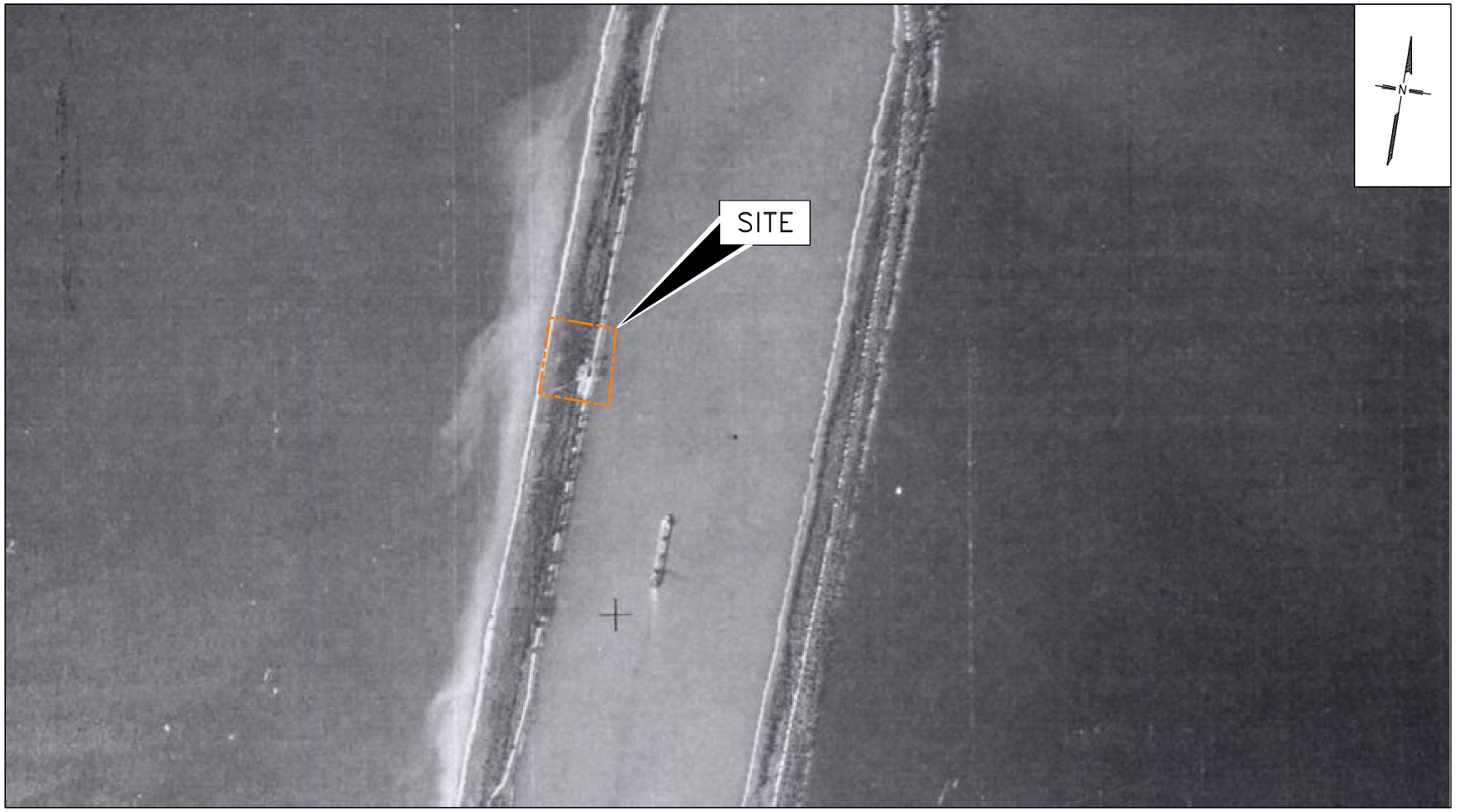
SCALE 1:10000

0 200 400m

SOURCE(S):
1. NATIONAL AIR PHOTO LIBRARY, AERIAL PHOTOGRAPHY, RA.15.72, 1927

AQUA TERRE

Client/Location: PUBLIC WORKS PORT WELLER SEARCH AND RESCUE STATION ST. CATHARINES, ON		Title: AERIAL PHOTOGRAPH (1927)	
Project No: 08228D	Filename: 01FB1_08228D	Date: OCTOBER 2008	Dwg No: FIGURE B.1
Drawn: FD	Verified:	Project Manager:	



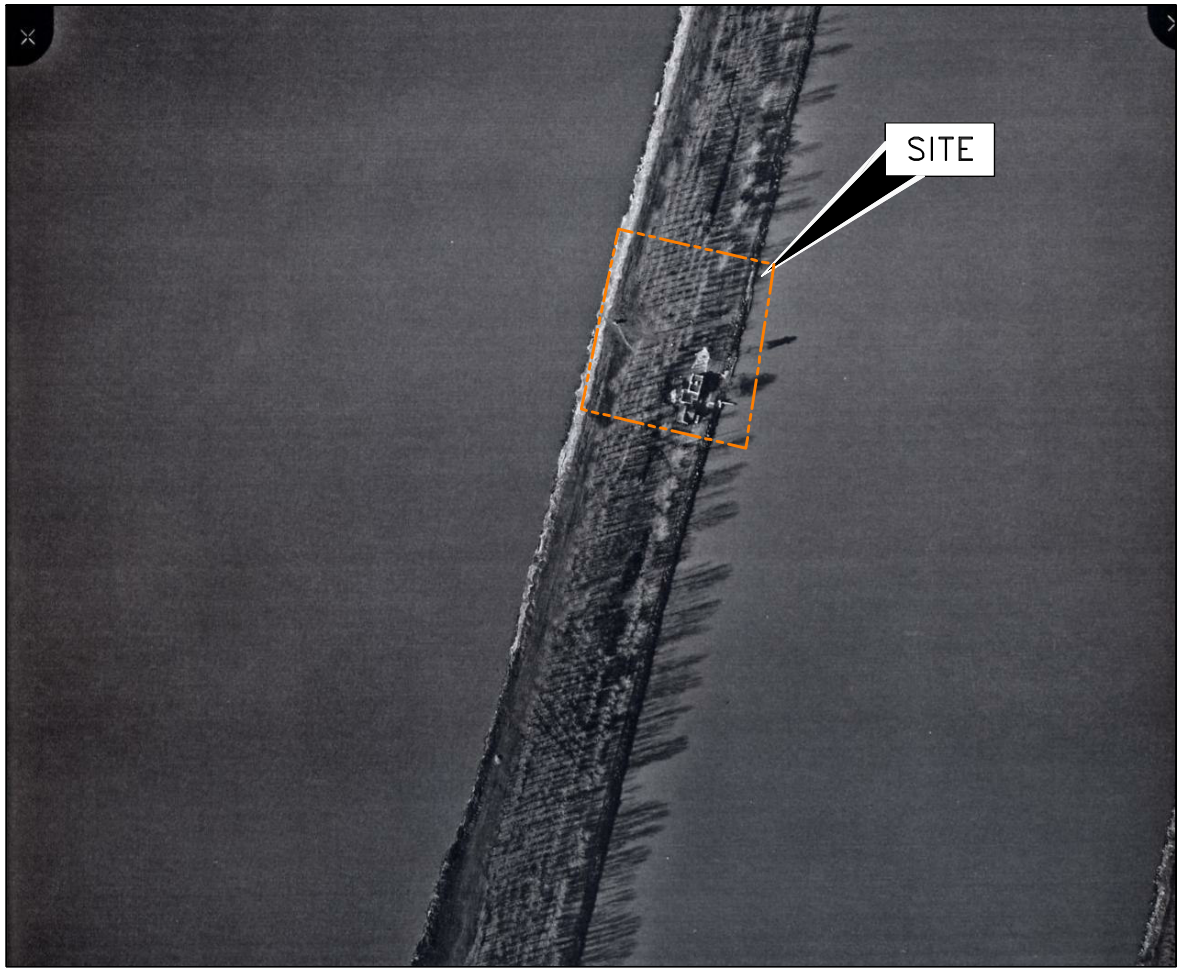
SCALE 1:10000

0 200 400m

SOURCE(S):
1. NATIONAL AIR PHOTO LIBRARY, AERIAL PHOTOGRAPHY, A11612–40, 1948

AQUA TERRE

Client/Location: PUBLIC WORKS PORT WELLER SEARCH AND RESCUE STATION ST. CATHARINES, ON		Title: AERIAL PHOTOGRAPHY (1948)	
Project No: 08228D	Filename: 01FB2_08228D	Date: OCTOBER 2008	Dwg No: FIGURE B.2
Drawn: FD	Verified:	Project Manager:	



N

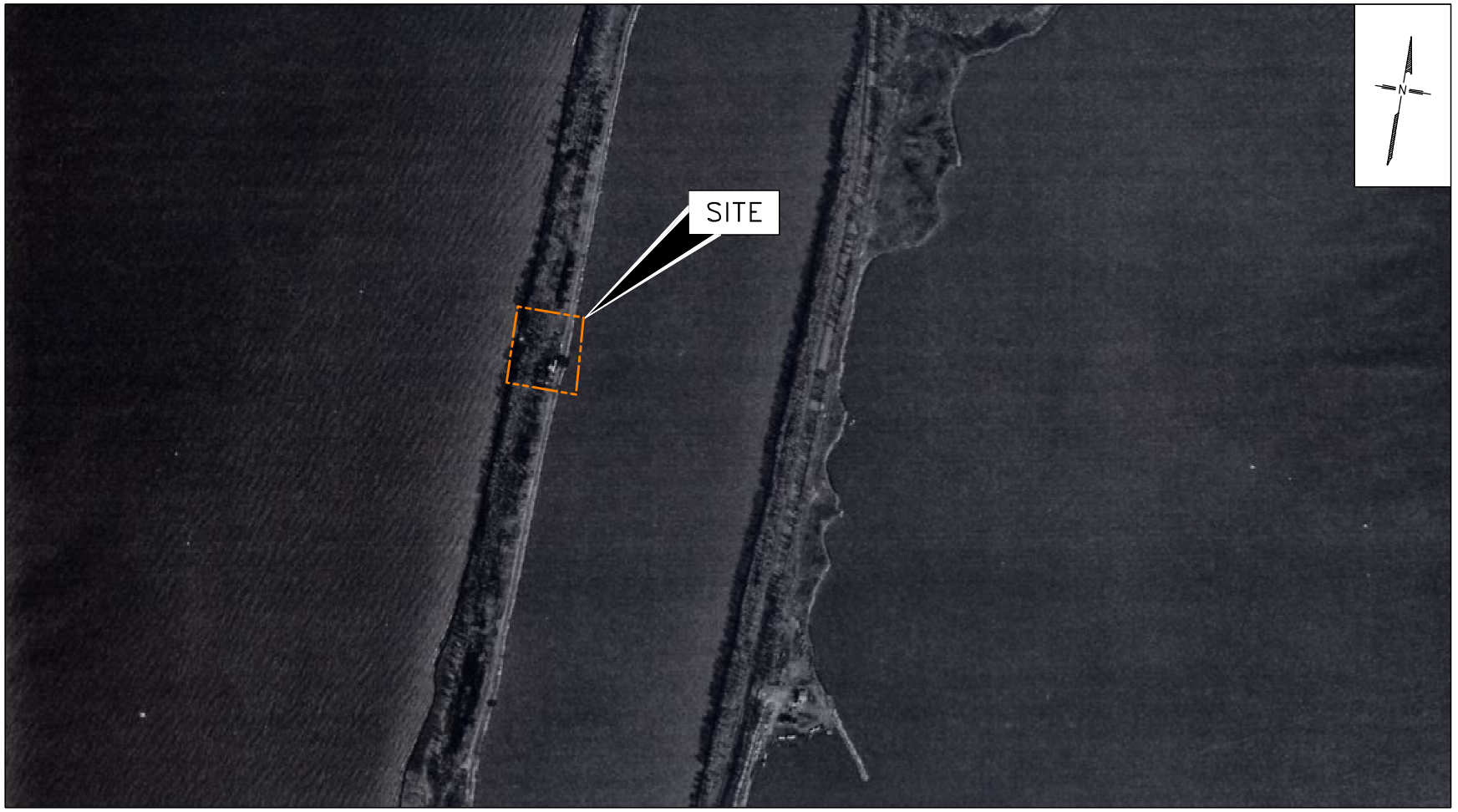
SCALE 1:5000

0 100 200m

SOURCE(S):
1. NATIONAL AIR PHOTO LIBRARY, AERIAL PHOTOGRAPHY, A19384–55, 1966

AQUA TERRE

Client/Location: PUBLIC WORKS PORT WELLER SEARCH AND RESCUE STATION ST. CATHARINES, ON		Title: AERIAL PHOTOGRAPH (1966)	
Project No: 08228D	Filename: 01FB3_08228D	Date: OCTOBER 2008	Dwg No: FIGURE B.3
Drawn: FD	Verified:	Project Manager:	



SCALE 1:10000

0 200 400m

SOURCE(S):
1. NATIONAL AIR PHOTO LIBRARY, AERIAL PHOTOGRAPHY, A23684–28, 1974

AQUA TERRE

Client/Location: PUBLIC WORKS PORT WELLER SEARCH AND RESCUE STATION ST. CATHARINES, ON		Title: AERIAL PHOTOGRAPH (1974)	
Project No: 08228D	Filename: 01FB4_08228D	Date: OCTOBER 2008	Dwg No: FIGURE B.4
Drawn: FD	Verified:	Project Manager:	

Appendix B

EcoLog ERIS Report

Pinpointing Your Environmental Risks

Environmental Risk Information Service

ECOLOG ERIS

Project Site:	**Port Weller Search and Rescue Station Canadian Coast Guard Government Road West St. Catharines, ON**
Client:	**Allison McIntosh Aqua Terre Solutions Inc. 200-1100 Sheppard Avenue West Toronto, ON M3K 2B4**
ERIS Project No:	**20080820019**
Report Type:	**Site Report - 0.25km Search Radius**
Prepared By:	**Mark Mattei mmattei@eris.ca**
Date:	**August 21, 2008**

12 Concorde Place, Suite 800 Toronto, Ontario M3C 4J2
Phone: (416) 510-5204 Fax: (416) 510-5133 Toll Free: 1-877-512-5204
www.ecologERIS.com info@ecologERIS.com

Table of Contents

Order Number: 20080820019
Site Name: Port Weller Search and Rescue Station Canadian Coast Guard
Site Address: Government Road West St. Catharines, ON
Report Type: Site Report, 0.25 km Search Radius

Report Summary

Order Number: 20080820019
Site Name: Port Weller Search and Rescue Station Canadian Coast Guard
Site Address Government Road West St. Catharines, ON
Report Type: Site Report, 0.25 km Search Radius

Number of Mappable Records Surrounding the Site

Database		Selected	On-site	Within 0.25	0.25km to 2.00km	Total
AAGR	Abandoned Aggregate Inventory	Y	0	0	0	0
AGR	Aggregate Inventory	Y	0	0	0	0
AMIS	Abandoned Mine Information System	Y	0	0	0	0
ANDR	Anderson's Waste Disposal Sites	Y	0	0	0	0
AUWR	Automobile Wrecking & Supplies	Y	0	0	0	0
CA	Certificates of Approval	Y	0	0	19	19
CFOT	Commercial Fuel Oil Tanks	Y	0	0	0	0
CHEM	Chemical Register	Y	0	0	0	0
COAL	Coal Gasification Plants	Y	0	0	0	0
CONV	Compliance and Convictions	Y	0	0	0	0
DRL	Drill Hole Databasa	Y	0	0	0	0
EBR	Environmental Registry	Y	0	0	7	7
EEM	Environmental Effects Monitoring	Y	0	0	0	0
EHS	ERIS Historical Searches	Y	0	0	4	4
EIIS	Environmental Issues Information System	Y	0	0	0	0
FCON	Federal Convictions	Y	0	0	0	0
FCS	Contaminated Sites on Federal Land	Y	0	0	3	3
FOFT	Fisheries & Oceans Fuel Storage Tanks	Y	0	0	0	0
FST	Fuel Storage Tank	Y	0	0	2	2
GEN	Ontario Regulation 347 Waste Generators Summary	Y	1	1	23	24
IAFT	Indian & Northern Affairs Fuel Tanks	Y	0	0	0	0
MINE	Canadian Mine Locations	Y	0	0	0	0
MNR	Mineral Occurrences	Y	0	0	0	0
NATE	National Analysis of Trends in Emergencies System (NATES)	Y	0	0	0	0
NCPL	Non-Compliance Reports	Y	0	0	0	0
NDFT	National Defence & Canadian Forces Fuel Storage Tanks	Y	0	0	0	0
NDSP	National Defence & Canadian Forces Spills	Y	0	0	0	0
NDWD	National Defence & Canadian Forces Waste Disposal Sites	Y	0	0	0	0
NEES	National Environmental Emergencies System (NEES)	Y	0	0	0	0
NPCB	National PCB Inventory	Y	0	0	0	0
NPRI	National Pollutant Release Inventory	Y	0	0	20	20
OGW	Oil and Gas Wells	Y	0	0	0	0
OOGW	Ontario Oil and Gas Wells	Y	0	0	0	0
OPCB	Inventory of PCB Storage Sites	Y	0	0	0	0
ORIS	Occurrence Reporting Information System	Y	0	0	41	41
PAP	Canadian Pulp and Paper	Y	0	0	0	0
PCFT	Parks Canada Fuel Storage Tanks	Y	0	0	0	0
PES	Pasticide Register	Y	0	0	4	4
PRT	Private and Retail Fuel Storage Tanks	Y	0	0	3	3
REC	Ontario Regulation 347 Waste Receivers Summary	Y	0	0	0	0
RSC	Record of Site Condition	Y	0	0	0	0
RST	Retail Fuel Storage Tanks	Y	0	0	1	1

Report Summary

Order Number: 20080820019
Site Name: Port Weller Search and Rescue Station Canadian Coast Guard
Site Address Government Road West St. Catharines, ON
Report Type: Site Report, 0.25 km Search Radius

Database		Selected	On-site	Within 0.25	0.25km to 2.00km	Total
SCT	Scott's Manufacturing Directory	Y	0	0	31	31
SRDS	Wastewater Discharger Registration Database	Y	0	0	0	0
TANK	Anderson's Storage Tanks	Y	0	0	0	0
TCFT	Transport Canada Fuel Storage Tanks	Y	0	0	0	0
WDS	Waste Disposal Sites - MOE CA Inventory	Y	0	0	0	0
WDSH	Waste Disposal Sites - MOE 1991 Historical Approval Inventory	Y	0	0	0	0
WWIS	Water Well Information System	Y	0	0	16	16
		TOTAL	1	1	174	175

The databases chosen by the client as per the submitted order form are denoted in the 'Selected' column in the above table. Counts have been provided outside the primary buffer area for cursory examination only. These records have not been examined or verified, therefore, they are subject to change.

SITE DIAGRAM

ECOLOG ERIS
Pinpointing Your Environmental Risks
12 Concorde Pl, Suite 800 North York, ON M3C 4J2
416-510-5204

Project Property: Port Weller Search and Rescue Station Canadian Coast Guard
Government Road West
St. Catharines, ON

ERIS Project #: 20080820019

Date: AUG-21-2008

LEGEND

- Project Property
- Database Location

Points of interest
- Chimney
- Silo

Pipe & Transmission Lines
- Pipeline
- Transmission Line
- Transmission Tower
- Transformer Station

Rail
- Railway - Main
- Railway - Sidetrack
- Railway - Abandoned
- Bridge
- Tunnel

Transportation - Other
- Embankment
- Trail
- Runway

Hydrographic Features
- Permanent Waterway
- Intermittent Waterway
- Open Reservoir
- Dyke/Levee
- Dam
- Breakwall
- Wetland

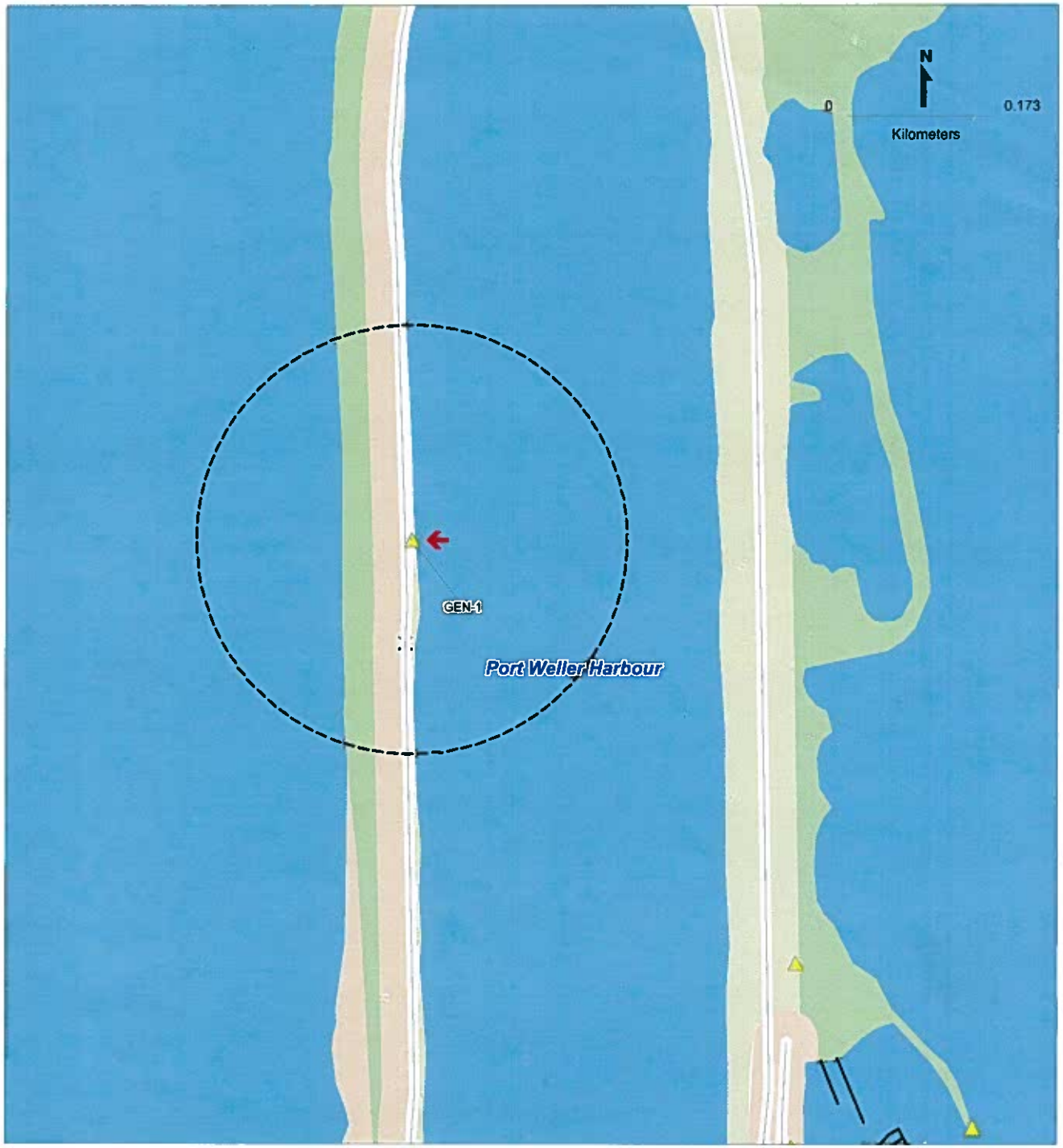
Landuse Classifications
- Open Area
- Residential
- Commercial
- Resource and Industrial
- Government and Institutional
- Parks and Recreational
- Waterbody

Recreation
- Golf Course/Driving Range
- Park/Sports Field
- Other Recreation Area
- Sports/Race Track
- Cemetery
- Campground

Vegetation
- Wooded Area
- Orchard
- Vineyard

industrial Resources
- Conveyor
- Crane: Moveable
- Crane: Stationary
- Tank
- Rock Cut
- Auto Wrecker
- Lumber Yard
- Pit

This diagram is to be used solely for relative street location purposes.
It may not accurately portray street or site positions.



Site Report

Order Number: 20080820019
Site Name: Port Weller Search and Rescue Station Canadian Coast Guard
Site Address Government Road West St. Catharines, ON
Report Type: Site Report, 0.25 km Search Radius

FOR COMPLETE INFORMATION, REFER TO DETAIL REPORT

Ontario Regulation 347 Waste Generators Summary

Map Key	Company Name	Address	City	Postal Code
GEN-1	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1	St. Catharines	L2R 6V8

Detail Report

Order Number: 20080820019
Site Name: Port Weller Search and Rescue Station Canadian Coast Guard
Site Address: Government Road West St. Catharines ON
Report Type: Site Report, 0.25 km Search Radius

If information is required for sites located beyond the selected address, please contact your ERIS representative.

Ontario Regulation 347 Waste Generators Summary

Ontario Regulation 347 Waste Generators Summary

Map Key	Company	Address	SIC Code	SIC Description	Waste Code	Waste Description
GEN-1	CANADIAN COAST GUARD	SEARCH & RESCUE STATION PORT WELLER End of the West Pier, Lock 1 St. Catharines L2R 6V8	**Generator #:** **Approval Yrs:**	ON0196514 02,03,04,05	221 251 252	LIGHT FUELS OIL SKIMMINGS & SLUDGES WASTE OILS & LUBRICANTS

Appendix: Ontario Database Descriptions

EcoLog Environmental Risk Information Services Ltd can search the following databases. The extent of historical information varies with each database and current information is determined by what is publicly available to EcoLog ERIS at the time of update. **Note:** Databases denoted with "*" indicates that the database will no longer be updated. See the individual database descriptions for more information.

Provincial Government Source Databases:

Abandoned Aggregate Inventory **Up to Sept 2002** **AAGR**

The MAAP Program maintains a database of all abandoned pits and quarries. Please note that the database is only referenced by lot and concession and city/town location. The database provides information regarding the location, type, size, land use, status and general comments.

Aggregate Inventory **Up to Oct 2007** **AGR**

The Ontario Ministry of Natural Resources maintains a database of all active pits and quarries. Please note that the database is only referenced by lot\concession and city/town location. The databases provides information regarding the registered owner/operator, location, status, licence type, and maximum tonnage.

Abandoned Mines Information System **1800- 2005** **AMIS**

The Abandoned Mines Information System contains data on known abandoned and inactive mines located on both Crown and privately held lands. The information was provided by the Ministry of Northern Development and Mines (MNDM), with the following disclaimer: "the database provided has been compiled from various sources, and the Ministry of Northern Development and Mines makes no representation and takes no responsibility that such information is accurate, current or complete". Reported information includes official mine name, status, background information, mine start/end date, primary commodity, mine features, hazards and remediation.

Certificates of Approval **1985-Sept 2002** **CA**

This database contains the following types of approvals: Certificates of Approval (Air) issued under Section 9 of the Ontario EPA; Certificates of Approval (Industrial Wastewater) issued under Section 53 of the Ontario Water Resources Act ("OWRA"); and Certificates of Approval (Municipal/Provincial Sewage and Waterworks) issued under Sections 52 and 53 of the OWRA.

Coal Gasification Plants **1987, 1988*** **COAL**

This inventory of all known and historical coal gasification plants was collected by the Ministry of Environment. It identifies industrial sites that produced and continue to produce or use coal tar and other related tars. Detailed information is available and includes: facility type, size, landuse, soil condition, site operators/occupants, site description, and potential environmental impacts. This information is effective to 1988, but the program has since been discontinued.

Compliance and Convictions **1989-June 2008** **CONV**

This database summarizes the fines and convictions handed down by the Ontario courts beginning in 1989. Companies and individuals named here have been found guilty of environmental offenses in Ontario courts of law.

Drill Holes 1886-2005 **DRL**

The Ontario Drill Hole Database contains information on more than 113,000 percussion, overburden, sonic and diamond drill holes from assessment files on record with the department of Mines and Minerals. Please note that limited data is available for southern Ontario, as it was the last area to be completed. The database was created when surveys submitted to the Ministry were converted in the Assessment File Research Image Database (AFRI) project. However, the degree of accuracy (coordinates) as to the exact location of drill holes is dependent upon the source document submitted to the MNDM. Levels of accuracy used to locate holes are: centering on the mining claim; a sketch of the mining claim; a 1:50,000 map; a detailed company map; or from submitted a "Report of Work".

Environmental Registry 1994-July 2003* **EBR**

The Environmental Registry lists proposals, decisions and exceptions regarding policies, Acts, instruments, or regulations that could significantly affect the environment. Through the Registry, provincial ministries notify the public of upcoming proposals and invite their comments. For example, if a local business is requesting a permit, licence, or certificate of approval to release substances into the air or water; these are notified on the registry.

Ontario Regulation 347 Waste Generators Summary 1986-2005 **GEN**

Regulation 347 of the Ontario EPA defines a waste generation site as any site, equipment and/or operation involved in the production, collection, handling and/or storage of regulated wastes. A generator of regulated waste is required to register the waste generation site and each waste produced, collected, handled, or stored at the site. This database contains the registration number, company name and address of registered generators including the types of hazardous wastes generated. This information is a summary of all years from 1986 including the most currently available data. Some records may contain, within the company name, the phrase "See & Use..." followed by a series of letters and numbers. This occurs when one company is amalgamated with or taken over by another registered company. The number listed as "See & Use", refers to the new ownership and the other identification number refers to the original ownership. This phrase serves as a link between the 2 companies until operations have been fully transferred.

Mineral Occurrences 1846-Oct 2007 **MNR**

In the early 70's, the Ministry of Northern Development and Mines created an inventory of approximately 19,000 mineral occurrences in Ontario, in regard to metallic and industrial minerals, as well as some information on building stones and aggregate deposits. Please note that the "Horizontal Positional Accuracy" is approximately +/- 200 m. Many reference elements for each record were derived from field sketches using pace or chain/tape measurements against claim posts or topographic features in the area. The primary limiting factor for the level of positional accuracy is the scale of the source material. The testing of horizontal accuracy of the source materials was accomplished by comparing the planimetric (X and Y) coordinates of that point with the coordinates of the same point as defined from a source of higher accuracy.

Non-Compliance Reports 1992(water only), 1994-2005 **NCPL**

The Ministry of the Environment provides information about non-compliant discharges of contaminants to air and water that exceed legal allowable limits, from regulated industrial and municipal facilities. A reported non-compliance failure may be in regard to a Control Order, Certificate of Approval, Sectoral Regulation or specific regulation/act.

Ontario Oil and Gas Wells 1800-2007 **OOGW**

In 1998, the MNR handed over to the Ontario Oil, Gas and Salt Resources Corporation, the responsibility of maintaining a database of oil and gas wells drilled in Ontario. Information available for all wells in the ERIS database include well owner/operator, location, permit start date, well cap date, licence number, status, depth and the primary target (rock unit) of the well being drilled.

Ontario Inventory of PCB Storage Sites 1987-Oct 2004 **OPCB**

The Ontario Ministry of Environment, Waste Management Branch, maintains an inventory of PCB storage sites within the province. Ontario Regulation 11/82 (Waste Management - PCB) and Regulation 347 (Generator Waste Management) under the Ontario EPA requires the registration of inactive PCB storage equipment and/or disposal sites of PCB waste with the Ontario Ministry of Environment. This database contains information on: 1) waste quantities; 2) major and minor sites storing liquid or solid waste; and 3) a waste storage inventory.

Occurrence Reporting Information System **1988-2002** **ORIS**

This database identifies sources, effects/actions and approximate locations of spills and occurrences within Ontario. The locations identified on the locator diagram refer to the facility responsible for the spill. The actual location of the spill can be derived from the descriptions provided in the detailed report.

Pesticide Register **1988-Sept 2007** **PES**

The Ontario Ministry of Environment maintains a database of all manufacturers and vendors of registered pesticides.

Private and Retail Fuel Storage Tanks **1989-1996*** **PRT**

The Fuels Safety Branch of the Ontario Ministry of Consumer and Commercial Relations maintained a database of all registered private fuel storage tanks and licensed retail fuel outlets. This database includes an inventory of locations that have gasoline, oil, waste oil, natural gas and/or propane storage tanks on their property. The MCCR no longer collects this information. This information is now collected by the Technical Standards and Safety Authority.

Ontario Regulation 347 Waste Receivers Summary **1986-2005** **REC**

Part V of the Ontario Environmental Protection Act ("EPA") regulates the disposal of regulated waste through an operating waste management system or a waste disposal site operated or used pursuant to the terms and conditions of a Certificate of Approval or a Provisional Certificate of Approval. Regulation 347 of the Ontario EPA defines a waste receiving site as any site or facility to which waste is transferred by a waste carrier. A receiver of regulated waste is required to register the waste receiving facility. This database represents registered receivers of regulated wastes, identified by registration number, company name and address. This information is a summary of all years from 1986 including the most currently available data.

Record of Site Condition **1997-Sept 2001, Oct 2004-June 2008** **RSC**

The Record of Site Condition (RSC) is part of the Ministry of the Environment's Brownfields Environmental Site Registry. Protection from environmental cleanup orders for property owners is contingent upon documentation known as a record of site condition (RSC) being filed in the Environmental Site Registry. In order to file an RSC, the property must have been properly assessed and shown to meet the soil, sediment and groundwater standards appropriate for the use, such as residential, proposed to take place on the property. The Record of Site Condition Regulation (O. Reg. 153/04) details requirements related to site assessment and clean up. Information available includes Registration Number, Filing Owner, Property Address, Filing Date and Municipality.

Wastewater Discharger Registration Database **1990-1998** **SRDS**

Information under this heading is combination of the following 2 programs. The Municipal/Industrial Strategy for Abatement (MISA) division of the Ontario Ministry of Environment maintained a database of all direct dischargers of toxic pollutants within nine sectors including: Electric Power Generation; Mining; Petroleum Refining; Organic Chemicals; Inorganic Chemicals; Pulp & Paper; Metal Casting; Iron & Steel; and Quarries. All sampling information is now collected and stored within the Sample Result Data Store (SRDS).

Waste Disposal Sites - MOE CA Inventory **1970-Sept 2002** **WDS**

The Ontario Ministry of Environment, Waste Management Branch, maintains an inventory of known open (active or inactive) and closed disposal sites in the Province of Ontario. Active sites maintain a Certificate of Approval, are approved to receive and are receiving waste. Inactive sites maintain Certificate(s) of Approval but are not receiving waste. Closed sites are not receiving waste. The data contained within this database was compiled from the MOE's Certificate of Approval database. Locations of these sites may be cross-referenced to the Anderson database described under ERIS's Private Source Database section, by the CA number.

Waste Disposal Sites - MOE 1991 Historical Approval Inventory **Up to Oct 1990*** **WDSH**

In June 1991, the Ontario Ministry of Environment, Waste Management Branch, published the "June 1991 Waste Disposal Site Inventory", of all known active and closed waste disposal sites as of October 30st, 1990. For each "active" site as of October 31st 1990, information is provided on site location, site/CA number, waste type, site status and site classification. For each "closed" site as of October 31st 1990, information is provided on site location, site/CA number, closure date and site classification. Locations of these sites may be cross-referenced to the Anderson database described under ERIS's Private Source Database section, by the CA number.

Water Well Information System **1955-2007** **WWIS**

This database describes locations and characteristics of water wells found within Ontario in accordance with Regulation 903. Geographic coordinates are reliable according to the given percentage. Wells that are identified with lot and concession only are now also included in the database and is no longer provided as a separate report.

Federal Government Source Databases: **Diagram Identifier:**

Environmental Effects Monitoring **1992-2004** **EEM**

The Environmental Effects Monitoring program assesses the effects of effluent from industrial or other sources on fish, fish habitat and human usage of fisheries resources. Since 1992, pulp and paper mills have been required to conduct EEM studies under the Pulp and Paper Effluent Regulations. This database provides information on the mill name, geographical location and sub-lethal toxicity data.

Environmental Issues Inventory System **1992-2001*** **EIIS**

The Environmental Issues Inventory System was developed through the implementation of the Environmental Issues and Remediation Plan. This plan was established to determine the location and severity of contaminated sites on inhabited First Nation reserves, and where necessary, to remediate those that posed a risk to health and safety; and to prevent future environmental problems. The EIIS provides information on the reserve under investigation, inventory number, name of site, environmental issue, site action (Remediation, Site Assessment), and date investigation completed.

Federal Convictions **1988-Jan 2002** **FCON**

Environment Canada maintains a database referred to as the "Environmental Registry" that details prosecutions under the Canadian Environmental Protection Act (CEPA) and the Fisheries Act (FA). Information is provided on the company name, location, charge date, offence and penalty.

Contaminated Sites on Federal Land **June 2000-Sept 2007** **FCS**

The Treasury Board of Canada Secretariat maintains an inventory of all known contaminated sites held by various Federal departments and agencies. This inventory does not include properties owned by Crown corporations, but does contain non-federal sites for which the Government of Canada has accepted some or all financial responsibility. All sites have been classified through a system developed by the Canadian Council of Ministers of the Environment. The database provides information on company name, location, site ID #, property use, classification, current status, contaminant type and plan of action for site remediation.

Fisheries & Oceans Fuel Tanks **1964-Sept 2003** **FOFT**

Fisheries & Oceans Canada maintains an inventory of all aboveground & underground fuel storage tanks located on Fisheries & Oceans property or controlled by DFO. Our inventory provides information on the site name, location, tank owner, tank operator, facility type, storage tank location, tank contents & capacity, and date of tank installation.

Indian & Northern Affairs Fuel Tanks **1950-Aug 2003** **IAFT**

The Department of Indian & Northern Affairs Canada (INAC) maintains an inventory of all aboveground & underground fuel storage tanks located on both federal and crown land. Our inventory provides information on the reserve name, location, facility type, site/facility name, tank type, material & ID number, tank contents & capacity, and date of tank installation.

National Analysis of Trends in Emergencies System (NATES) **1974-1994*** **NATE**

In 1974 Environment Canada established the National Analysis of Trends in Emergencies System (NATES) database, for the voluntary reporting of significant spill incidents. The data was to be used to assist in directing the work of the emergencies program. NATES ran from 1974 to 1994. Extensive information is available within this database including company names, place where the spill occurred, date of spill, cause, reason and source of spill, damage incurred, and amount, concentration, and volume of materials released.

National Defence & Canadian Forces Fuel Tanks **Up to May 2001** **NDFT**

The Department of National Defence and the Canadian Forces maintains an inventory of all aboveground & underground fuel storage tanks located on DND lands. Our inventory provides information on the base name, location, tank type & capacity, tank contents, tank class, date of tank installation, date tank last used, and status of tank as of May 2001. This database will no longer be updated due to the new National Security protocols which have prohibited any release of this database.

National Defence & Canadian Forces Spills **Mar 1999-Oct 2007** **NDSP**

The Department of National Defence and the Canadian Forces maintains an inventory of spills to land and water. All spill sites have been classified under the "Transportation of Dangerous Goods Act - 1992". Our inventory provides information on the facility name, location, spill ID #, spill date, type of spill, as well as the quantity of substance spilled & recovered.

National Defence & Canadian Forces Waste Disposal Sites **2001, 2003** **NDWD**

The Department of National Defence and the Canadian Forces maintains an inventory of waste disposal sites located on DND lands. Where available, our inventory provides information on the base name, location, type of waste received, area of site, depth of site, year site opened/closed and status.

National Environmental Emergencies System (NEES) **1974-2003** **NEES**

In 2000, the Emergencies program implemented NEES, a reporting system for spills of hazardous substances. For the most part, this system only captured data from the Atlantic Provinces, some from Quebec and Ontario and a portion from British Columbia. Data for Alberta, Saskatchewan, Manitoba and the Territories was not captured. However, NEES is also a repository for all previous Environment Canada spill datasets. NEES is composed of the historic datasets – or Trends – which dates from approximately 1974 to present. **NEES Trends** is a compilation of historic databases, which were merged and includes data from NATES (National Analysis of Trends in Emergencies System), ARTS (Atlantic Regional Trends System), and NEES. In 2001, the Emergencies Program determined that variations in reporting regimes and requirements between federal and provincial agencies made national spill reporting and trend analysis difficult to achieve. As a consequence, the department has focused efforts on capturing data on spills of substances which fall under its legislative authority only (CEPA and FA). As such, the NEES database will be decommissioned in December 2004.

National PCB Inventory **1988-June 2004** **NPCB**

Environment Canada's National PCB inventory includes information on in-use PCB containing equipment in Canada including federal, provincial and private facilities. All federal out-of-service PCB containing equipment and all PCB waste owned by the federal government or by federally regulated industries such as airlines, railway companies, broadcasting companies, telephone and telecommunications companies, pipeline companies, etc. are also listed. Although it is not Environment Canada's mandate to collect data on non-federal PCB waste, the National PCB inventory includes some information on provincial and private PCB waste and storage sites.

National Pollutant Release Inventory 1993-2006 **NPRI**

Environment Canada has defined the National Pollutant Release Inventory ("NPRI") as a federal government initiative designed to collect comprehensive national data regarding releases to air, water, or land, and waste transfers of 178 specified substances.

Parks Canada Fuel Storage Tanks 1920-Jan 2005 **PCFT**

Canadian Heritage maintains an inventory of all known fuel storage tanks operated by Parks Canada, in both National Parks and at National Historic Sites. The database details information on site name, location, tank install/removal date, capacity, fuel type, facility type, tank design and owner/operator.

Transport Canada Fuel Storage Tanks 1970-March 2007 **TCFT**

With the provinces of BC, MB, NB, NF, ON, PE, and QC; Transport Canada currently owns and operates 90 fuel storage tanks. This inventory will also include The Pickering Lands, which refers to the 7,530 hectares (18,600 acres) of land in Pickering, Markham and Uxbridge - owned by the Government of Canada since 1972. Properties on this land has been leased by the government since 1975, falls under the Site Management Policy of Transport Canada, but administered by Public Works and Government Services Canada. Our inventory provides information on the site name, location, tank age, capacity and fuel type.

Private Source Databases:

Anderson's Waste Disposal Sites 1860s-Present **ANDR**

The information provided in this database was collected by examining various historical documents which aimed to characterize the likely position of former waste disposal sites from 1860 to present. The research initiative behind the creation of this database was to identify those sites that are missing from the *Ontario MOE Waste Disposal Site Inventory*, as well as to provide revisions and corrections to the positions and descriptions of sites currently listed in the MOE inventory. In addition to historic waste disposal facilities, the database also identifies certain auto wreckers and scrap yards that have been extrapolated from documentary sources. *Please note that the data is not warranted to be complete, exhaustive or authoritive. The information was collected for research purposes only.*

Automobile Wrecking & Supplies 2001-Feb 2007 **AUWR**

This database provides an inventory of all known locations that are involved in the scrap metal, automobile wrecking/recycling, and automobile parts & supplies industry. Information is provided on the company name, location and business type.

Commercial Fuel Oil Tanks 1948-Sept 2006 **CFOT**

Since May 2002, Ontario developed a new act where it became mandatory for fuel oil tanks to be registered with TSSA. This data would include all commercial underground fuel oil tanks in Ontario with fields such as location, registration number, tank material, age of tank and tank size.

Chemical Register 1992, 1999-Feb 2007 **CHEM**

This database includes information from both a one time study conducted in 1992 and private source and is a listing of facilities that manufacture or distribute chemicals. The production of these chemical substances may involve one or more chemical reactions and/or chemical separation processes (i.e. fractionation, solvent extraction, crystallization, etc.).

ERIS Historical Searches 1999-2007 **EHS**

EcoLog ERIS has compiled a database of all environmental risk reports completed since March 1999. Available fields for this database include: site location, date of report, type of report, and search radius. As per all other databases, the ERIS database can be referenced on both the map and "Statistical Profile" page.

Fuel Storage Tanks **Current to August 2007** **FST**

The TSSA, under the *Technical Standards & Safety Act* of 2000 maintains a database of registered private and retail fuel storage tanks in Ontario with fields such as location, tank status, license date, tank type, tank capacity, fuel type, installation year and facility type.

Canadian Mine Locations **1998-2006** **MINE**

This information is collected from the Canadian & American Mines Handbook. The Mines database is a national database that provides over 290 listings on mines (listed as public companies) dealing primarily with precious metals and hard rocks. Listed are mines that are currently in operation, closed, suspended, or are still being developed (advanced projects). Their locations are provided as geographic coordinates (x, y and/or longitude, latitude). As of 2002, data pertaining to Canadian smelters and refineries has been appended to this database.

Oil and Gas Wells **Oct 2001-Mar 2008** **OGW**

The Nickle's Energy Group (publisher of the Daily Oil Bulletin) collects information on drilling activity including operator and well statistics. The well information database includes name, location, class, status and depth. The main Nickles' database is updated on a daily basis, however, this database is updated on a monthly basis. More information is available at www.nickles.com.

Canadian Pulp and Paper **1999, 2002, 2004, 2005** **PAP**

This information is part of the Pulp and Paper Canada Directory. The Directory provides a comprehensive listing of the locations of pulp and paper mills and the products that they produce.

Retail Fuel Storage Tanks **2000-Feb 2007** **RST**

This database includes an inventory of retail fuel outlet locations (including marinas) that have on their property gasoline, oil, waste oil, natural gas and / or propane storage tanks. Information is provided on company name, location and type of business.

Scott's Manufacturing Directory **1992-Jan 2007** **SCT**

Scott's Directories is a data bank containing information on over 70,000 manufacturers in Ontario. Even though Scott's listings are voluntary, it is the most comprehensive database of Ontario manufacturers available. Information concerning a company's address, plant size, and main products are included in this database. This database begins with 1992 information and is updated annually.

Anderson's Storage Tanks **1915-1953*** **TANK**

The information provided in this database was collected by examining various historical documents, which identified the location of former storage tanks, containing substances such as fuel, water, gas, oil, and other various types of miscellaneous products. Information is available in regard to business operating at tank site, tank location, permit year, permit & installation type, no. of tanks installed & configuration and tank capacity. *Data contained within this database pertains only to the city of Toronto and is not warranted to be complete, exhaustive or authoritative. The information was collected for research purposes only.*

Appendix C

Correspondence

ISO 9001 Certified

Risk Management Services

150 Commerce Valley Drive W
8th Floor
Markham, Ontario
L3T 7Z3
Tel. (905) 882-6300 x 5405
Fax. (905) 695-6543

SCM - Risk Management Environmental Services

Historical Environmental Reporting System (HEIRS™)

Eleanor Goolab
EcologERIS
12 Concorde Place, Suite 800
Toronto, ON
M3C 4J2

August 28, 2008

Regarding: Government Road West, St.Catharines, ON - 20080820019

As requested, we have searched our records concerning the above site and the following information as listed below is appended hereto:

Information	Date(s)
Fire Insurance Plan(s)	NRF
Property Underwriters' Report(s)	NO
Property Underwriters' Plan(s)	NO

NRF: No Records Found NO: Not Ordered

Our invoice in the amount of $40.00 (+ GST) for the information provided will follow in due course.

Thank you for employing our services.

Devon Mallay
Environmental Services

New Website – www.cgi-ibs.com/iao

Environment Canada / Environnement Canada
Terrasses de la Chaudière
10 Wellington Street, 4th Floor
Gatineau, Québec
K1A 0H3

Your File *Votre référence*

Our File *Notre référence*
A-2008-00601 / jle

November 7, 2008

Mrs. Allison McIntosh
Aqua Terre Solutions Inc.
2 Gurdwara Rd., Suite 200
Nepean, Ontario
K2E 1A2

Dear Mrs. McIntosh:

This is to acknowledge receipt on November 6, 2008 of your request under the Access to Information Act (the Act) for:

> "Environmental Compliance (Phase 1)
>
> Owner: Department of Fisheries and Ocean.
>
> Address: 1 - Wheatley Small Craft Harbour, Part of Lot 24, Concession 3 and Part of Original Road Allowance between counties of Essex & Kent, in the Township of Mersea, County of Essex and Part of the Bed of Lake Erie in front of Part of Lot 1, Broken Front Concession and Part of Original Road Allowance between counties of Essex & Kent in the Municipality of Chatham-Kent. The site is located in Wheatley Ontario and does not have a municipal address. DFRP # 54020.
> 2 - Port Weller Search and Rescue Station, Canadian Coast Guard, Bunting Road in Port Weller (St. Catherines), ON. The site is situated on the west breakwater between Lake Ontario and the Welland Canal and does not have a municipal address. DFRP # 86422.
>
> Any environmental information on file for the properties including, but not limited to, records of spills, releases, approvals, permits, licenses, infractions, orders or previous environmental investigations.
>
> Authorization by: {Matthew Graham}"

Attached please find the receipt of the $5.00 application fee paid from your credit card account.

We have started processing your request and will contact you as soon as possible.

.../2

If you have any questions regarding this request, do not hesitate to contact me at (819) 994-4497. Please quote the above file number on all future correspondence concerning this request.

Yours sincerely,

Julie Lebrun

Julie Lebrun
Access to Information and
Privacy Secretariat

Ministry of
the Environment

Freedom of Information and
Protection of Privacy Office

12th Floor
40 St. Clair Avenue West
Toronto ON M4V 1M2
Tel: (416) 314-4075
Fax: (416) 314-4285

Ministère de
l'Environnement

Bureau de l'accès à l'information
et de la protection de la vie privée

12e étage
40, avenue St. Clair ouest
Toronto ON M4V 1M2
Tél. : (416) 314-4075
Téléc. : (416) 314-4285

Ontario

October 3, 2008

Ms. Allison McIntosh
Aqua Terre Solutions Inc
200 - 1100 Sheppard Ave W
Toronto ON M3K 2B4

Dear Ms. McIntosh:

RE: *Freedom of Information and Protection of Privacy Act* Request
Our File # A-2008-03814, Your Reference 08228D

This letter is in response to your request made pursuant to the *Freedom of Information and Protection of Privacy Act* relating to Port Weller Search and Rescue Station - End of West Pier Lock '1', Westside of the Welland Canal, (Government Road West), Port Weller Harbour - Note: Port Weller Commanding Officer CCGC Cape Storm c/o St Lawrence Seaway Authority.

After a thorough search of the Ministry's Environmental Monitoring and Reporting Branch, Investigations and Enforcement Branch, Niagara District Office, SDW-Niagara, Sector Compliance Branch, records were located in response to your request. It is my decision to provide full access to the attached information.

To provide you with a copy of the records and in accordance with Section 57 of the *Freedom of Information and Protection of Privacy Act*, **the fee is:**

• Search Time 1 hour @ $30/hour	$30.00
• Copying 9 pages @ $0.20/page	$1.80
• Delivery	$3.00
• **Total**	**$ 34.80**
• Deposit received	- 30.00
• **BALANCE WAIVED (NOT REQUIRED)**	**$4.80**

To conduct a search through the files of the Environmental Assessment and Approvals Branch requires an additional 13 hours. If you would like us to search for Certificates of Approval at the Environmental Assessment and Approvals Branch, **please forward to me at the above address payment by cheque (made payable to the "Minister of Finance (FOI)") or credit card in the amount of $390.00**. Please note that there is no guarantee that any records will be located. Please note, a request for records must usually be answered within 30 calendar days, however Section 27 allows for time extensions under certain circumstances. If you choose to have the search conducted at the Environmental Assessment and Approvals Branch, the time for answering your request will be extended for an additional 30 days.

If you object to any decision I have made, you may request a review by contacting the Information and Privacy Commissioner/Ontario, 2 Bloor Street East, Suite 1400, Toronto, Ontario M4W 1A8 (800-387-0073 or 416-326-3333). Please note that there is a $25.00 fee and you only have 30 days from receipt of this letter to request a review.

If you have any questions regarding this matter, please contact Wendy Terhune at (416) 212-0561.

Yours truly,

Donna Currie
FOI Coordinator
Information Management and Access Branch

Attachments

Ministry of Environment and Energy / Ministère de l'Environnement et de l'Énergie

Ontario

Generator Registration Report
Rapport d'inscription du producteur

7-4-31

Please mail completed form to:
Environmental Monitoring & Reporting Branch, Ministry of Environment and Energy, 135 St. Clair Avenue West, **AREA "M"**
Toronto, Ontario M4V 1P5

MINISTRY OF ENVIRONMENT WELLAND DISTRICT OFFICE

IE PW

Veuillez faire parvenir le formulaire dûment rempli à l'adresse suivante :
Direction de la surveillance environnementale, ministère de l'Environnement et de l'Énergie, 135, avenue St. Clair ouest, ***SECTEUR M***
Toronto ON M4V 1P5

'96 DEC -2 A11 :35 203

Part I – Generator Identification / *Partie I – Identification du producteur*

This report is / *Le présent rapport constitue* .

Generator Registration Number / *N d'inscription du producteur*: ONO19857

1. ☑ an initial generator registration report / *un premier rapport d'inscription du producteur*

or / *ou*

2. ☐ a revision – enter Ontario Generator Registration No. / *une révision – veuillez donner le numéro d'inscription du producteur (Ontario)*

3. For generators located outside of Ontario, enter Registration or Notification number assigned by your local environmental authority. / *Si vous êtes un producteur de l'extérieur de l'Ontario, veuillez inscrire le numéro d'inscription/d'identification attribué par les autorités locales en matière d'environnement.*

Name of Generator (Enter the corporate name or, if a partnership or proprietorship, the name of the principal(s). If the generator intends to carry on business under a separate name or style, this should also be entered.) / *Nom du producteur (Veuillez inscrire la dénomination sociale ou, s'il s'agit d'une société en nom collectif ou d'une société à propriétaire unique, le nom du (des) principal (principaux) propriétaire(s). Si le producteur envisage d'exploiter une entreprise sous une dénomination ou un nom distinct, veuillez également le noter.)*

4. Name / *Nom*: CANADIAN COAST GUARD

5. Address / *Adresse*: 401 KING ST, PO BOX 1000

6. Municipality / *Municipalité*: PRESCOTT | Province/State / *Province, État*: ONT | Postal Code / *Code postal*: K0E1T0

7. Site location / *Emplacement des installations*: SEARCH & RESCUE STATION PORT WELLER C/O ST LAWRENCE SEAWAY AUTHORITY, BOX 370

8. Municipality / *Municipalité*: ST CATHERINES (Niagara-on-the-Lake) | Province/State / *Province, État*: ONT | Postal Code / *Code postal*: L2R6V8

9. Name of contact / *Nom de la personne à contacter*: COX SWAIN | Tel. No. / *N° de tél.*: 9059342446

10. Standard Industrial Classification Codes (SIC) for Site noted in Section 7. / *Codes de la classification type des industries pour les installations dont l'adresse figure au n° 7* : 9125

11. Total number of wastes to be registered with this report / *Nombre total de déchets à inscrire dans ce rapport*: 003

12. Name of Company Official / *Nom du représentant autorisé de la compagnie*: J. C. Wall

13. Position / *Poste*: Asst Supt Comm

14. Signature / *Signature*: [signature]

15. Date / *Date*: 1996/12/02

16. **Ministry Use Only / Réservé au Ministère**

County Code / *Code de comté*	12
Regional/District Code / *Code de région/district*	02-203
Municipal Code / *Code de municipalité*	2120210
Inter City Tie Line / *Ligne privée interurbaine*	

Part 2 – Waste Identification / *Partie 2 – Nature des déchets*

(Please complete one Page 2 for each waste stream to be registered) / *(Veuillez photocopier cette page et remplir une pour chaque flux de déchets à inscrire.)*

1. Description of Waste / *Description des déchets*

DIESEL Fuel

2. Description of generating process / *Description du procédé de production*

TANK DRAININGS, CLEAN UPS.

3. Waste quantity generated or accumulated / *Quantité de déchets produite ou accumulée*

50

kg/mo. / *kg/mois*

4. Primary characteristic / *Caractéristique principale*

LIQUID INDUSTRIAL WASTE

Analytical data (if applicable). If the data has been estimated, attach separate sheet outlining the basis for the estimate. / *Données analytiques (le cas échéant). Si les données sont estimatives, veuillez annexer une feuille à part pour décrire sur quoi reposent les estimations.*

Name of Laboratory (if applicable). / *Laboratoire (le cas échéant)*

Waste Class / *Catégorie de déchets*: 221

Hazardous Waste Number / *Numéro de déchets dangereux*:

Specific Gravity / *Masse volumique*: 0.80

Physical State (Solid - S, Liquid - L, Gas - G) / *État: (solide - S, liquide - L, gaz - G)*: L

For Ministry Use only / Réservé au Ministère

5. Secondary Characteristic / *Caractéristique secondaire*

Analytical data (if applicable) / *Données analytiques (le cas échéant)*

Part 3 – Waste Management / *Partie 3 – Gestion des déchets*

1. Principal Intended Receiver / *Réceptionnaire principal prévu*

Company name and address / *Nom et adresse de la compagnie*

MARINE CLEAN
PO BOX 2205

Receiver No. / *N° du réceptionnaire*: ONA1V9001

Municipality / *Municipalité*: NIAGARA FALLS

Province/State / *Province/État*: ONT

Postal Code / *Code postal*: L2E6Z3

2. Principal Intended Carrier / *Transporteur principal prévu*

Company name and address / *Nom et adresse de la compagnie*

MARINE CLEAN
PO BOX 2205

MOEE Carrier No. / *N° du MEEO du transporteur*: A820068

Municipality / *Municipalité*: NIAGARA FALLS

Province/State / *Province/État*: ONT

Postal Code / *Code postal*: L2E6Z3

Part 2 – Waste Identification / *Partie 2 – Nature des déchets*

(Please complete one Page 2 for each waste stream to be registered) / *(Veuillez photocopier cette page et la remplir une pour chaque flux de déchets à inscrire.)*

1. Description of Waste / *Description des déc*

2. Description of generating process / *Description du procédé de production*

3. Waste quantity generated or accumulated / *Quantité de déchets produite ou accumulée*

kg/mo. / *kg/mois*

4. Primary characteristic / *Caractéristique principale*

Analytical data (if applicable). If the data has been estimated, attach separate sheet outlining the basis for the estimate. / *Données analytiques (le cas échéant). Si les données sont estimatives, veuillez annexer une feuille à part pour décrire sur quoi reposent les estimations.*

Name of Laboratory (if applicable). / *Laboratoire (le cas échéant)*

Waste Class / *Catégorie de déchets*

Hazardous Waste Number / *Numéro de déchets dangereux*

Specific Gravity / *Masse volumique*

Physical State (Solid - S, Liquid - L, Gas - G) / *État (solide - S, liquide - L, gaz - G)*

For Ministry Use only / *Réservé au Ministère*

5. Secondary Characteristic / *Caractéristique secondaire*

Analytical data (if applicable) / *Données analytiques (le cas échéant)*

Part 3 – Waste Management / *Partie 3 – Gestion des déchets*

1. **Principal Intended Receiver** / *Réceptionnaire principal prévu*

Company name and address / *Nom et adresse de la compagnie*

Receiver No. / *N° du réceptionnaire*

Municipality / *Municipalité*

Province/State / *Province/État*

Postal Code / *Code postal*

2. **Principal Intended Carrier** / *Transporteur principal prévu*

Company name and address / *Nom et adresse de la compagnie*

MOEE Carrier No. / *N° du MEEO du transporteur*

Municipality / *Municipalité*

Province/State / *Province/État*

Postal Code / *Code postal*

Part 2 – Waste Identification / *Partie 2 – Nature des déchets*

(Please complete one Page 2 for each waste stream to be registered) / *(Veuillez photocopier cette page et remplir une pour chaque flux de déchets à inscrire.)*

1. Description of Waste / *Description des déch...*

2. Description of generating process / *Description du procédé de production*

3. Waste quantity generated or accumulated / *Quantité de déchets produite ou accumulée*

kg/mo. / *kg/mois*

4. Primary characteristic / *Caractéristique principale*

Analytical data (if applicable). If the data has been estimated, attach separate sheet outlining the basis for the estimate. / *Données analytiques (le cas échéant). Si les données sont estimatives, veuillez annexer une feuille à part pour décrire sur quoi reposent les estimations.*

Name of Laboratory (if applicable). / *Laboratoire (le cas échéant)*

Waste Class / *Catégorie de déchets*

Hazardous Waste Number / *Numéro de déchets dangereux*

Specific Gravity / *Masse volumique*

Physical State (Solid - S, Liquid - L, Gas - G) / *État (solide - S, liquide - L, gaz - G)*

For Ministry Use only / *Réservé au Ministère*

5. Secondary Characteristic / *Caractéristique secondaire*

Analytical data (if applicable) / *Données analytiques (le cas échéant)*

Part 3 – Waste Management / *Partie 3 – Gestion des déchets*

1. Principal Intended Receiver / *Réceptionnaire principal prévu*

Company name and address / *Nom et adresse de la compagnie*

Receiver No. / *N° du réceptionnaire*

Municipality / *Municipalité*

Province/State / *Province/État*

Postal Code / *Code postal*

2. Principal Intended Carrier / *Transporteur principal prévu*

Company name and address / *Nom et adresse de la compagnie*

MOEE Carrier No. / *N° du MEEO du transporteur*

Municipality / *Municipalité*

Province/State / *Province/État*

Postal Code / *Code postal*

Ministry of
Environment
and Energy

135 St. Clair Avenue West
Toronto ON M4V 1P5

Ministère de
l'Environnement
et de l'Énergie

135, avenue St. Clair ouest
Toronto ON M4V 1P5

Ontario

October 31, 1996

CANADIAN COAST GUARD
C/O ST. LAWRENCE SEAWAY
AUTHORITY, P.O. BOX 370
ST. CATHARINES, ONT
L2R 6V8

Attention: MR. TIM GILLIGAN

Re: Acknowledgement of Subject Waste Registration

In accordance with Subsection 18(3) of Ontario Regulation 347, this letter acknowledges receipt of your Generator Registration Report dated **September 16, 1996.** The Generator Registration Number assigned to your company is:

ON0196514

for the site located at:

SEARCH & RESCUE STATION PORT WELLER
NIAGARA-ON-THE-LAKE, ONT

A list of acknowledged waste number(s) is attached as Schedule "A". The format of this schedule has been modified since July 1993. A waste number now appears only once, regardless of the number of different waste streams which may have identical waste numbers. The waste description is also generic. However, you are still required to register all waste streams, even if they have identical waste numbers.

For off-site disposal of subject waste, the appropriate waste number(s) acknowledged in Schedule "A", and the Generator Registration Number, must be entered in Part A of each manifest form after receipt of this generator registration document. Under Ontario's Environmental Protection Act, the property receiving the waste must be approved as a disposal site for the waste it is receiving. The disposal of waste at an uncertified site is illegal.

The selection of accurate waste numbers is your responsibility. This acknowledgement must **not** be considered a confirmation of the accuracy of the information submitted by you. Should the waste number(s) **you have selected** be deemed incorrect by the Ministry, or improper waste disposal occurs at any time, you may be subject to legal action as provided by the Environmental Protection Act and Regulation 347.

It is important to note that under Subsection 18(4) of Regulation 347, a supplementary Generator Registration Report must be submitted to the Ministry within 15 days for any of the following reasons:

1. if the name, address or telephone number of your company or generating site changes, or

2. if there is a significant change in the description, the waste number, or the physical or chemical characteristics of your registered waste(s), or

3. **if you generate a hazardous or liquid industrial waste that has not been registered with the Ministry, even if its waste number is already listed on Schedule "A".**

Your Generator Registration Report has been forwarded to the District Office of this Ministry that is closest to your generating site. Staff of the District Office conduct post-registration audits and may contact you for additional information or may visit your site.

Should you have any questions concerning generator registration or manifesting requirements, please contact the appropriate District Office of the Ministry.

Toronto	(416)326-6700	Owen Sound	(519)371-2901
Halton-peel	(905)637-4150	Sarnia	(519)336-4030
York-Durham	(905)427-5600	Windsor	(519)254-2546
Hamilton	(905)521-7650	Sudbury	(705)675-4501
Cambridge	(519)622-8121	North Bay	(705)476-1001
Welland	(905)732-0816	Gravenhurst	(705)687-6647
Kingston	(613)549-4000	Barrie	(705)726-1730
Cornwall	(613)933-7402	Thunder Bay	(807)475-1315
Ottawa	(613)521-3450	Kenora	(807)468-2718
Peterborough	(705)743-2972	Sault Ste. Marie	(705)949-4640
London	(519)661-2200	Timmins	(705)268-3222

D. Tolson

Director
Regulation 347, R.R.O., 1990
Environmental Protection Act

SCHEDULE "A"

In accordance with information submitted with your generator registration report(s), the site indicated below is registered for the waste number(s) shown on this schedule, which **may represent more than one waste stream.** This attached Schedule forms part of the acknowledgement of generator registration for the following site:

CANADIAN COAST GUARD

SEARCH & RESCUE STATION PORT WELLER
NIAGARA-ON-THE-LAKE, ONT

identified by Generator Registration Number **ON0196514**, dated in Toronto, October 31, 1996.

WASTE STREAM	WASTE NUMBER
1. LIGHT FUELS	221I
2. OIL SKIMMINGS & SLUDGES	251L
3. WASTE OILS & LUBRICANTS	252L

---- End of List ----

Generator Details

Registration/Notification Number

ON0196514

Legal Company Name

Primary Name:	CANADIAN COAST GUARD	Division Name:	Search & Rescue

Company Operating Name

Primary Name:	CANADIAN COAST GUARD	Division Name:	NA

Mailing Address

Division Building:	NA	Post Box Number:	1000
Address Line 1:	P. O. BOX 1000	Address Line 2:	401 KING STREET
Town/City:	PRESCOTT	Postal Code / Zip Code:	K0E 1T0
County: (If inside Ontario)	LEEDS & GRENVILLE	Province/State (If inside Canada/US)	ONTARIO
County: (if outside Ontario)	NA	Province / State (If outside Canada / US)	NA
Country:	Canada		

Site Location

This should be the street address of the site that is being registered. You are required to register each site that generates hazardous waste separately.

Division Building:	Cape Storm	Post Box Number:	NA
Address Line 1:	SEARCH & RESCUE STATION PORT WELLER		
Address Line 2:	End of the West Pier, Lock 1		
Town/City:	St. Catharines	Postal Code / Zip Code:	L2R 6V8
County: (if Inside Ontario)	NIAGARA (R. M.)	Province / State (If inside Canada / US)	ONTARIO
County: (if outside Ontario)	NA	Province / State (If outside Canada / US)	NA
Country:	Canada		

mpany Name: CANADIAN COAST GUARD Search & Rescue
ompany Number: ON0196514 (Generator)

Active Waste Classes

Active Waste Class Listing

Add New Waste Class Inactive waste classes

Active Off-site Waste Classes

Waste Class	Physical State	Off-Site	Status	View Details	UnRegister Waste Class
221 - I	Liquid	Off-Site	Active	View details	☐
251 - L	Liquid	Off-Site	Active	View Details	☐
252 - L	Liquid	Off-Site	Active	View Details	☐

Unregister Selected Classes

Back

Appendix D

Site Inspection Photographs

Photograph 1: View of office/residence building.

Photograph 2: View of dock.

Photograph 3: View of fuel dispenser at Ready building.

Photograph 4: View of Ready building and dock.

Photograph 5: View of MNR building.

Photograph 6: View of 935-L fuel oil AST.

Photograph 7: View of 935-L fuel oil AST and 910-L diesel AST.

Photograph 8: View of 11,000-L diesel AST.

Photograph 9: View of 11,000-L diesel AST.

Photograph 10: 1,100-L fuel oil AST on west side of office/residence building.

Photograph 11: View of potable water well – looking north on west side of office/residence building.

Photograph 12: View of grounds – looking west.

Photograph 13: View of 1,900-L gasoline AST and 500-L waste oil AST.

Photograph 14: Environment Canada Hydrometric Gauging station.

Photograph 15: Storage shed located at north end of site.

Photograph 16: Storage trailer located at north end of site.

Photograph 17: Looking north from access road.

Photograph 18: Looking south from access road.

Photograph 19: View of surface water well used for irrigation.

Photograph 20: 1,900L gasoline AST-looking west.

Photograph 21: 1,100-L fuel oil AST.

Photograph 22: Piping from 11,000-L diesel AST to sump.

Appendix E

Tank Inspection Checklist

DATA FOR FUEL STORAGE TANKS – 500 L Waste Oil Aboveground Storage Tank

DATA REQUIRED FROM SCHEDULE II OF THE PROPOSED STORAGE TANK SYSTEMS FOR PETROLEUM PRODUCTS AND ALLIED PETROLEUM PRODUCTS (GAZETTE PART I, APRIL 2007)

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner

   Canadian Coast Guard Search and Rescue, Port Weller, ON

2. Mailing address of owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

3. Name and mailing address of operator, if different than storage tank owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

4. Name of landowner, if different than storage tank owner

   St. Lawrence Seaway Management Corporation

5. Type of facility (use DFO categories)

   Search and Rescue Station

6a. Location (civic address) of storage tank system, if different than address of owner, or if no civic address use DFRP coordinates or GPS latitude/longitude.

   NAD 83 Zone 17 378833E, 4657859N

6b. Civic address where tank system records are stored.

   Central and Arctic Region Head Office,
   Fisheries and Oceans
   520 Exmouth St.
   Sarnia, ON
   N7T 8B1

7a. Number of months the system has been in service.

   Approximately 216 months

7.b Nominal Capacity of each storage tank.

   1 tank with 500 L capacity.

8. Type of petroleum product or allied petroleum product stored

   Waste oil

9. Year of installation of each storage tank in the system

Approximately 1991

10a. Type of each tank (AST/UST/partly buried)

AST

10b. Each tank's ULC of API Standard number.

B76c

10c. Type of storage tank material for each storage tank in the system.

Double wall steel

10d. Corrosion protection of each tank

Surfaces painted

10e. Secondary containment of each tank

n/a

10f. Type of overfill protection of each tank

none

11a. Type of piping (AG/UG).

none

11b. Type of piping material

n/a

11c. Diameter of piping.

n/a

11d. Corrosion protection of the piping

n/a

11e. Secondary containment of the piping.

n/a

12a. Type of spill containment devices

Fill sump

12b. Description of transfer area (ie: concrete pad, canopy, oil-water separator, delivery truck to tank)

Tank is supported by a concrete pad

13. Type of pump or pumps

    n/a

14. Type of leak detection

    n/a

15. Internal linings, if any

    n/a

16. Number and location of monitoring wells

    none

17. Type of volatile organic compound (VOC) emission control

    none

18. Manufacturer of each storage tank in the system

    King Metal Fabricator Inc.

Registrations of aboveground storage tank systems must also include:

19. Type of diking.

    none

20. Type of storage tank, whether horizontal or vertical

    vertical

DATA FOR FUEL STORAGE TANKS – 1,900 L Gasoline Aboveground Storage Tank

DATA REQUIRED FROM SCHEDULE II OF THE PROPOSED STORAGE TANK SYSTEMS FOR PETROLEUM PRODUCTS AND ALLIED PETROLEUM PRODUCTS (GAZETTE PART I, APRIL 2007)

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner

   Canadian Coast Guard Search and Rescue, Port Weller, ON

2. Mailing address of owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

3. Name and mailing address of operator, if different than storage tank owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

4. Name of landowner, if different than storage tank owner

   St. Lawrence Seaway Management Corporation

5. Type of facility (use DFO categories)

   Search and Rescue Station

6a. Location (civic address) of storage tank system, if different than address of owner, or if no civic address use DFRP coordinates or GPS latitude/longitude.

   NAD 83 Zone 17 378833E, 4657859N

6b. Civic address where tank system records are stored.

   Central and Arctic Region Head Office,
   Fisheries and Oceans
   520 Exmouth St.
   Sarnia, ON
   N7T 8B1

7a. Number of months the system has been in service.

   Approximately 192 months

7.b Nominal Capacity of each storage tank.

   1 tank with 1,900 L capacity.

8. Type of petroleum product or allied petroleum product stored

   Gasoline

9. Year of installation of each storage tank in the system

Approximately 1993

10a. Type of each tank (AST/UST/partly buried)

AST

10b. Each tank's ULC of API Standard number.

B15665GC

10c. Type of storage tank material for each storage tank in the system.

Double wall steel

10d. Corrosion protection of each tank

Concrete containment

10e. Secondary containment of each tank

Concrete containment

10f. Type of overfill protection of each tank

Overfill protection valve

11a. Type of piping (AG/UG).

none

11b. Type of piping material

n/a

11c. Diameter of piping.

n/a

11d. Corrosion protection of the piping

n/a

11e. Secondary containment of the piping.

n/a

12a. Type of spill containment devices

Fill sump

12b. Description of transfer area (ie: concrete pad, canopy, oil-water separator, delivery truck to tank)

Tank is supported by a concrete pad

13. Type of pump or pumps

    n/a

14. Type of leak detection

    n/a

15. Internal linings, if any

    n/a

16. Number and location of monitoring wells

    none

17. Type of volatile organic compound (VOC) emission control

    none

18. Manufacturer of each storage tank in the system

    ConVault by Spancrete NE Inc..

Registrations of aboveground storage tank systems must also include:

19. Type of diking.

    Steel secondary containment

20. Type of storage tank, whether horizontal or vertical

    horizontal

DATA FOR FUEL STORAGE TANKS
11,000 L Diesel Fuel Aboveground Storage Tank

DATA REQUIRED FROM SCHEDULE II OF THE PROPOSED STORAGE TANK SYSTEMS FOR PETROLEUM PRODUCTS AND ALLIED PETROLEUM PRODUCTS (GAZETTE PART I, APRIL 2007)

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner

   Canadian Coast Guard Search and Rescue, Port Weller, ON

2. Mailing address of owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

3. Name and mailing address of operator, if different than storage tank owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

4. Name of landowner, if different than storage tank owner

   St. Lawrence Seaway Management Corporation

5. Type of facility (use DFO categories)

   Search and Rescue Station

6a. Location (civic address) of storage tank system, if different than address of owner, or if no civic address use DFRP coordinates or GPS latitude/longitude.

   NAD 83 Zone 17 378833E, 4657859N

6b. Civic address where tank system records are stored.

   Central and Arctic Region Head Office,
   Fisheries and Oceans
   520 Exmouth St.
   Sarnia, ON
   N7T 8B1

7a. Number of months the system has been in service.

   Approximately 216 months

7.b Nominal Capacity of each storage tank.

   1 tank with 11,000 L capacity.

8. Type of petroleum product or allied petroleum product stored

Diesel

9. Year of installation of each storage tank in the system

Approximately 1991

10a. Type of each tank (AST/UST/partly buried)

AST

10b. Each tank's ULC of API Standard number.

Con 4 – s601 No. 15c

10c. Type of storage tank material for each storage tank in the system.

Steel

10d. Corrosion protection of each tank

Surfaces painted

10e. Secondary containment of each tank

Steel containment dike

10f. Type of overfill protection of each tank

Overfill protection valve

11a. Type of piping (AG/UG).

AG & UG

11b. Type of piping material

Galvanized steel and fiberglass

11c. Diameter of piping.

Not observed

11d. Corrosion protection of the piping

Sealed plastic conduit

11e. Secondary containment of the piping.

n/a

12a. Type of spill containment devices

Fill sump

12b. Description of transfer area (ie: concrete pad, canopy, oil-water separator, delivery truck to tank)

Tank is supported by a concrete pad

13. Type of pump or pumps

Tuthill Corporation Model 17419

14. Type of leak detection

Not identifiable

15. Internal linings, if any

n/a

16. Number and location of monitoring wells

none

17. Type of volatile organic compound (VOC) emission control

none

18. Manufacturer of each storage tank in the system

AREO Power Fueler Inc. Trenton Machine Tool Inc.

Registrations of aboveground storage tank systems must also include:

19. Type of diking.

Steel secondary containment

20. Type of storage tank, whether horizontal or vertical

horizontal

DATA FOR FUEL STORAGE TANKS – 910 L Diesel Fuel Aboveground Storage Tank

(A copy of this form will be filled out for each tank system at the request of the DFO Project Director. Note: regions should seek additional requirements from their regional tank system database/tanks file colleague. EC/PWGSC form to follow at a later date)

DATA REQUIRED FROM SCHEDULE II OF THE PROPOSED STORAGE TANK SYSTEMS FOR PETROLEUM PRODUCTS AND ALLIED PETROLEUM PRODUCTS (GAZETTE PART I, APRIL 2007)

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner

   Canadian Coast Guard Search and Rescue, Port Weller, ON

2. Mailing address of owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

3. Name and mailing address of operator, if different than storage tank owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

4. Name of landowner, if different than storage tank owner

   St. Lawrence Seaway Management Corporation

5. Type of facility (use DFO categories)

   Search and Rescue Station

6a. Location (civic address) of storage tank system, if different than address of owner, or if no civic address use DFRP coordinates or GPS latitude/longitude.

   NAD 83 Zone 17 378833E, 4657859N

6b. Civic address where tank system records are stored.

   Central and Arctic Region Head Office,
   Fisheries and Oceans
   520 Exmouth St.
   Sarnia, ON
   N7T 8B1

7a. Number of months the system has been in service.

   Approximately 156 months

7.b Nominal Capacity of each storage tank.

1 tank with 910 L capacity.

8. Type of petroleum product or allied petroleum product stored

Diesel Fuel

9. Year of installation of each storage tank in the system

Approximately 1996

10a. Type of each tank (AST/UST/partly buried)

AST

10b. Each tank's ULC of API Standard number.

Not identifiable

10c. Type of storage tank material for each storage tank in the system.

Steel

10d. Corrosion protection of each tank

Surfaces painted

10e. Secondary containment of each tank

None/Not applicable

10f. Type of overfill protection of each tank

Level gauge and vent whistle

11a. Type of piping (AG/UG).

AG

11b. Type of piping material

copper

11c. Diameter of piping.

n/a

11d. Corrosion protection of the piping

n/a

11e. Secondary containment of the piping.

n/a

12a. Type of spill containment devices

n/a

12b. Description of transfer area (ie: concrete pad, canopy, oil-water separator, delivery truck to tank)

Tank is supported by a concrete pad

13. Type of pump or pumps

n/a

14. Type of leak detection

n/a

15. Internal linings, if any

n/a

16. Number and location of monitoring wells

none

17. Type of volatile organic compound (VOC) emission control

none

18. Manufacturer of each storage tank in the system

not identifiable

Registrations of aboveground storage tank systems must also include:

19. Type of diking.

none

20. Type of storage tank, whether horizontal or vertical

horizontal

DATA FOR FUEL STORAGE TANKS – 935 L Fuel Oil Aboveground Storage Tank

DATA REQUIRED FROM SCHEDULE II OF THE PROPOSED STORAGE TANK SYSTEMS FOR PETROLEUM PRODUCTS AND ALLIED PETROLEUM PRODUCTS (GAZETTE PART I, APRIL 2007)

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner

   Canadian Coast Guard Search and Rescue, Port Weller, ON

2. Mailing address of owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

3. Name and mailing address of operator, if different than storage tank owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

4. Name of landowner, if different than storage tank owner

   St. Lawrence Seaway Management Corporation

5. Type of facility (use DFO categories)

   Search and Rescue Station

6a. Location (civic address) of storage tank system, if different than address of owner, or if no civic address use DFRP coordinates or GPS latitude/longitude.

   NAD 83 Zone 17 378833E, 4657859N

6b. Civic address where tank system records are stored.

   Central and Arctic Region Head Office,
   Fisheries and Oceans
   520 Exmouth St.
   Sarnia, ON
   N7T 8B1

7a. Number of months the system has been in service.

   Approximately 108 months

7.b Nominal Capacity of each storage tank.

   1 tank with 935 L capacity.

8. Type of petroleum product or allied petroleum product stored

   Fuel Oil

9. Year of installation of each storage tank in the system

Approximately 2000

10a. Type of each tank (AST/UST/partly buried)

AST

10b. Each tank's ULC of API Standard number.

21795c

10c. Type of storage tank material for each storage tank in the system.

Steel

10d. Corrosion protection of each tank

Surfaces painted

10e. Secondary containment of each tank

None/Not applicable

10f. Type of overfill protection of each tank

Level gauge and vent whistle

11a. Type of piping (AG/UG).

AG

11b. Type of piping material

copper

11c. Diameter of piping.

n/a

11d. Corrosion protection of the piping

n/a

11e. Secondary containment of the piping.

n/a

12a. Type of spill containment devices

n/a

12b. Description of transfer area (ie: concrete pad, canopy, oil-water separator, delivery truck to tank)

Tank is supported by a concrete pad

13. Type of pump or pumps

    At furnace/not observed

14. Type of leak detection

    n/a

15. Internal linings, if any

    n/a

16. Number and location of monitoring wells

    none

17. Type of volatile organic compound (VOC) emission control

    none

18. Manufacturer of each storage tank in the system

    DTE Industries Inc.

Registrations of aboveground storage tank systems must also include:

19. Type of diking.

    none

20. Type of storage tank, whether horizontal or vertical

    horizontal

DATA FOR FUEL STORAGE TANKS – 1,100 L Fuel Oil Aboveground Storage Tank

DATA REQUIRED FROM SCHEDULE II OF THE PROPOSED STORAGE TANK SYSTEMS FOR PETROLEUM PRODUCTS AND ALLIED PETROLEUM PRODUCTS (GAZETTE PART I, APRIL 2007)

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner

   Canadian Coast Guard Search and Rescue, Port Weller, ON

2. Mailing address of owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

3. Name and mailing address of operator, if different than storage tank owner

   508 Glendale Avenue, Box 370, St. Catharines, ON, L2R 6V8

4. Name of landowner, if different than storage tank owner

   St. Lawrence Seaway Management Corporation

5. Type of facility (use DFO categories)

   Search and Rescue Station

6a. Location (civic address) of storage tank system, if different than address of owner, or if no civic address use DFRP coordinates or GPS latitude/longitude.

   NAD 83 Zone 17 378833E, 4657859N

6b. Civic address where tank system records are stored.

   Central and Arctic Region Head Office,
   Fisheries and Oceans
   520 Exmouth St.
   Sarnia, ON
   N7T 8B1

7a. Number of months the system has been in service.

   Approximately 144 months

7.b Nominal Capacity of each storage tank.

   1 tank with 1,100 L capacity.

8. Type of petroleum product or allied petroleum product stored

Fuel Oil

9. Year of installation of each storage tank in the system

Approximately 1997

10a. Type of each tank (AST/UST/partly buried)

AST

10b. Each tank's ULC of API Standard number.

221221c

10c. Type of storage tank material for each storage tank in the system.

Steel

10d. Corrosion protection of each tank

Surfaces painted

10e. Secondary containment of each tank

None/Not applicable

10f. Type of overfill protection of each tank

Level gauge and vent whistle

11a. Type of piping (AG/UG).

AG

11b. Type of piping material

copper

11c. Diameter of piping.

n/a

11d. Corrosion protection of the piping

n/a

11e. Secondary containment of the piping.

n/a

12a. Type of spill containment devices

n/a

12b. Description of transfer area (ie: concrete pad, canopy, oil-water separator, delivery truck to tank)

Tank is supported by a concrete pad

13. Type of pump or pumps

At furnace/not observed

14. Type of leak detection

n/a

15. Internal linings, if any

n/a

16. Number and location of monitoring wells

none

17. Type of volatile organic compound (VOC) emission control

none

18. Manufacturer of each storage tank in the system

Hassen Steel Fabrication

Registrations of aboveground storage tank systems must also include:

19. Type of diking.

none

20. Type of storage tank, whether horizontal or vertical

horizontal

Appendix F

Borehole Logs

Borehole ID: BH-101

Project No.: 08228D
Client: PWGSC
Location: Port Weller Search and Rescue
Date Completed: September 26, 2008
Site Datum: Not Surveyed

ATSI Supervisor: Allison McIntosh
Drilling Method: Percussion
Borehole Diameter: 5.08 cm

Drilling Company: GEDI
Drilling Equipment: Pionjar
OVM: GasTech 1238 ME

DEPTH (ft)	DEPTH (m)	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)
								Ground Surface	0.00
0	0							TOPSOIL	
1		NA	BH-101-1		<25	50		SILT FILL moist, purplish/grey, trace fine sand and gravel	
2									
3	1	NA	BH-101-2	◆	25	55			
4								End of borehole at 1.30 m.	
5									
6	2								
7									
8									
9									
10	3								
11									
12									
13	4								
14									
15									
16	5								
17									
18									
19	6								
20									

(1) Blow count per 0.15 m using conventional hammer and split spoons
(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

◆ = Sample submitted for laboratory analysis

Borehole ID: BH-102

Project No.: 08228D
Client: PWGSC
Location: Port Weller Search and Rescue
Date Completed: September 26, 2008
Site Datum: Not Surveyed

ATSI Supervisor: Allison McIntosh
Drilling Method: Percussion
Borehole Diameter: 5.08 cm

Drilling Company: GEDI
Drilling Equipment: Pionjar
OVM: GasTech 1238 ME

DEPTH (ft)	DEPTH (m)	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)
								Ground Surface	0.00
0	0							TOPSOIL	
1		NA	BH-102-1		<25	47		CLAY and SILT FILL moist, brown grey, trace fine sand	
2									
3	1	NA	BH-102-2	◆	25	100			
4									
5		NA	BH-102-3		<25	100			
6	2								
7								End of borehole at 1.98 m.	
8									
9									
10	3								
11									
12									
13	4								
14									
15									
16	5								
17									
18									
19	6								
20									

(1) Blow count per 0.15 m using conventional hammer and split spoons
(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

◆ = Sample submitted for laboratory analysis

Borehole ID: BH-103

Project No.: 08228D
Client: PWGSC
Location: Port Weller Search and Rescue
Date Completed: September 26, 2008
Site Datum: Not Surveyed

ATSI Supervisor: Allison McIntosh
Drilling Method: Percussion
Borehole Diameter: 5.08 cm

Drilling Company: GEDI
Drilling Equipment: Pionjar
OVM: GasTech 1238 ME

DEPTH (ft / m)	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)
0 / 0							Ground Surface	0.00
0 – 1 / 0	NA	BH-103-1	◆	25	85		GRAVEL clayey SILT FILL moist, brown, trace fine sand and gravel	
2 – 3 / 1	NA	BH-103-2		<25	93			
4 – 5 / 1	NA	BH-103-3		<25	85			
6 / 2							End of borehole at 1.78 m.	
7 – 20 / 2 – 6								

(1) Blow count per 0.15 m using conventional hammer and split spoons
(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

◆ = Sample submitted for laboratory analysis

Borehole ID: BH-104

Project No.: 08228D
Client: PWGSC
Location: Port Weller Search and Rescue
Date Completed: September 26, 2008
Site Datum: Not Surveyed

ATSI Supervisor: Allison McIntosh
Drilling Method: Percussion
Borehole Diameter: 5.08 cm

Drilling Company: GEDI
Drilling Equipment: Pionjar
OVM: GasTech 1238 ME

DEPTH (ft)	DEPTH (m)	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)
								Ground Surface	0.00
0	0							TOPSOIL	
1		NA	BH-104-1		<25	60		SILT FILL moist, grey brown, trace fine sand and gravel	
2									
3	1	NA	BH-104-2	◆	25	100			
4									
5		NA	BH-104-3		<25	93			
6	2							End of borehole at 1.78 m.	
7									
8									
9									
10	3								
11									
12									
13	4								
14									
15									
16	5								
17									
18									
19	6								
20									

(1) Blow count per 0.15 m using conventional hammer and split spoons
(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

◆ = Sample submitted for laboratory analysis

Borehole ID: BH-105

Project No.: 08228D
Client: PWGSC
Location: Port Weller Search and Rescue
Date Completed: September 26, 2008
Site Datum: Not Surveyed

ATSI Supervisor: Allison McIntosh
Drilling Method: Percussion
Borehole Diameter: 5.08 cm

Drilling Company: GEDI
Drilling Equipment: Pionjar
OVM: GasTech 1238 ME

DEPTH (ft / m)	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)
0 / 0							Ground Surface	0.00
0 / 0							TOPSOIL	
1 /	NA	BH-105-1	◆	25	68		SILT and CLAY FILL moist, brown, trace fine sand and gravel	
2 /								
3 / 1	NA	BH-105-2		<25	85			
4 /								
5 /	NA	BH-105-3		<25	47			
6 /							End of borehole at 1.63 m.	
7 / 2								
8 /								
9 /								
10 / 3								
11 /								
12 /								
13 / 4								
14 /								
15 /								
16 / 5								
17 /								
18 /								
19 / 6								
20 /								

(1) Blow count per 0.15 m using conventional hammer and split spoons
(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

◆ = Sample submitted for laboratory analysis

Borehole ID: BH-106

Project No.: 08228D
Client: PWGSC
Location: Port Weller Search and Rescue
Date Completed: September 26, 2008
Site Datum: Not Surveyed

ATSI Supervisor: Allison McIntosh
Drilling Method: Percussion
Borehole Diameter: 5.08 cm

Drilling Company: GEDI
Drilling Equipment: Pionjar
OVM: GasTech 1238 ME

DEPTH (ft / m)	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)
0 / 0							Ground Surface	0.00
0 – 1 / 0	NA	BH-106-1	◆	50	100		TOPSOIL SILT FILL moist, purplish brown grey, trace clay, fine sand and gravel	
2 – 3 / 1	NA	BH-106-2		<25	100		silty CLAY FILL moist, purplish brown grey, trace fine sand	
4 – 5 / 1	NA	BH-106-3		<25	100			
6 / 2							End of borehole at 1.78 m.	
7 – 20 / 2 – 6								

(1) Blow count per 0.15 m using conventional hammer and split spoons
(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

◆ = Sample submitted for laboratory analysis

Borehole ID: BH-107

Project No.: 08228D
Client: PWGSC
Location: Port Weller Search and Rescue
Date Completed: September 26, 2008
Site Datum: Not Surveyed

ATSI Supervisor: Allison McIntosh
Drilling Method: Percussion
Borehole Diameter: 5.08 cm

Drilling Company: GEDI
Drilling Equipment: Pionjar
OVM: GasTech 1238 ME

DEPTH (ft)	DEPTH (m)	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)
								Ground Surface	0.00
0	0							TOPSOIL	
1		NA	BH-107-1		<25	68		SILT FILL moist, brown, trace clay, fine sand and gravel	
2									
3	1	NA	BH-107-2		<25	77		wet	
4									
5		NA	BH-107-3	◆	25	77		red	
6	2								
7								End of borehole at 2.08 m.	
8									
9									
10	3								
11									
12									
13	4								
14									
15									
16	5								
17									
18									
19	6								
20									

(1) Blow count per 0.15 m using conventional hammer and split spoons
(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

◆ = Sample submitted for laboratory analysis

Borehole ID: BH-108

Project No.: 08228D
Client: PWGSC
Location: Port Weller Search and Rescue
Date Completed: September 26, 2008
Site Datum: Not Surveyed

ATSI Supervisor: Allison McIntosh
Drilling Method: Percussion
Borehole Diameter: 5.08 cm

Drilling Company: GEDI
Drilling Equipment: Pionjar
OVM: GasTech 1238 ME

DEPTH (ft)	DEPTH (m)	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)
								Ground Surface	0.00
0	0							TOPSOIL	
1		NA	BH-108-1	◆	50	60		SILT FILL moist, grey brown, trace fine sand and gravel	
2									
3	1	NA	BH-108-2		25	60			
4								End of borehole at 1.24 m.	
5									
6	2								
7									
8									
9									
10	3								
11									
12									
13	4								
14									
15									
16	5								
17									
18									
19	6								
20									

(1) Blow count per 0.15 m using conventional hammer and split spoons
(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

◆ = Sample submitted for laboratory analysis

Appendix G

Laboratory Certificates of Analysis
(Soil)

Your Project #: 08-228D - SOIL/PWSAR
Site: PORT WELLER SEARCH AND RESCUE
Your C.O.C. #: 96329-01

Attention: Austin Sweezey
Aqua Terre Solutions Inc
Nepean
20 Colonnade Road, Suite 110
Ottawa, ON
K2E 7M6

Report Date: 2008/10/06

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A8B1533
Received: 2008/09/27, 10:13

Sample Matrix: Soil
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Hot Water Extractable Boron	6	2008/10/02	2008/10/03	CAM SOP-00408	EPA 3050B
Free Cyanide	6	N/A	2008/10/03	CAM SOP-00457	EPA 9012 modified
Conductivity	6	N/A	2008/10/03	CAM SOP-00414	APHA 2510
Chromium (VI) in Soil	6	2008/09/30	2008/10/01	CAM SOP-00420	EPA 3060A
Petroleum Hydro. CCME F1 & BTEX in Soil	4	2008/09/29	2008/09/30	CAM SOP-00315	CCME CWS
Petroleum Hydro. CCME F1 & BTEX in Soil	4	2008/09/29	2008/10/01	CAM SOP-00315	CCME CWS
Petroleum Hydrocarbons F2-F4 in Soil	8	2008/09/30	2008/10/01	CAM SOP-00316	CCME CWS
Mercury in Soil by CVAA	6	2008/10/02	2008/10/03	CAM SOP-00453	EPA 7470
Acid Extr. Metals (aqua regia) by ICPMS	6	2008/10/02	2008/10/02	CAM SOP-00447	EPA 6020
MOISTURE	1	N/A	2008/09/29	CAM SOP-00445	McKeague 2nd ed 1978
MOISTURE	7	N/A	2008/10/02	CAM SOP-00445	McKeague 2nd ed 1978
PAH Compounds in Soil by GC/MS (SIM)	1	2008/09/30	2008/10/01	CAM SOP - 00318	EPA 8270
pH CaCl2 EXTRACT	1	N/A	2008/10/02	Ont SOP-0067	4500-H+B
pH CaCl2 EXTRACT	6	N/A	2008/10/03	Ont SOP-0067	4500-H+B
Sieve, 75um (1)	1	N/A	2008/09/29	CAM SOP-00467	
Sodium Adsorption Ratio (SAR)	6	2008/09/27	2008/10/04	Ont SOP 0072	EPA 6010
Volatile Organic Compounds in Soil	2	N/A	2008/10/02	CAM SOP-00226	EPA 8260 modified
Volatile Organic Compounds in Soil	6	N/A	2008/10/03	CAM SOP-00226	EPA 8260 modified

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

(1) The Sieve test has been validated in accordance with ISO Guide 17025 requirements. SCC accreditation pending.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

MELISSA MORRISON, Project Manager
Email: Melissa.Morrison@maxxamanalytics.com
Phone# (613) 274-0573

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CAEAL have approved this reporting process and electronic report format.

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

For Service Group specific validation please refer to the Validation Signature Page

Total cover pages: 2

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

RESULTS OF ANALYSES OF SOIL

Maxxam ID		AP7356		AP7357		
Sampling Date		2008/09/26 09:15		2008/09/26 10:00		
	Units	BH-101-2	QC Batch	BH-102-2	RDL	QC Batch
Calculated Parameters						
Sodium Adsorption Ratio	N/A	3.0	1627161		N/A	
Inorganics						
Conductivity	mS/cm	0.18	1633159		0.002	
Free Cyanide	ug/g	<0.01	1631738		0.01	
Moisture	%	10	1631971	20	0.2	1631971
Available (CaCl2) pH	pH	7.78	1633151	7.66		1631761
Miscellaneous Parameters						
Grain Size	%			FINE	N/A	1627382
Sieve - #200 (<0.075mm)	%			92	N/A	1627382
Sieve - #200 (>0.075mm)	%			8.2	N/A	1627382

Maxxam ID		AP7358		AP7359	AP7360	AP7361	AP7362	AP7363		
Sampling Date		2008/09/26 10:30		2008/09/26 11:00	2008/09/26 11:15	2008/09/26 11:45	2008/09/26 12:15	2008/09/26 12:30		
	Units	BH-103-1	QC Batch	BH-104-2	BH-105-1	BH-106-1	BH-107-3	BH-108-1	RDL	QC Batch
Calculated Parameters										
Sodium Adsorption Ratio	N/A	0.19	1627161	0.43		1.1	0.46	0.87	N/A	1627161
Inorganics										
Conductivity	mS/cm	0.40	1633159	0.56		0.25	1.5	0.23	0.002	1633159
Free Cyanide	ug/g	<0.01	1631738	<0.01		<0.01	<0.01	<0.01	0.01	1631738
Moisture	%	17	1627813	13	19	10	22	16	0.2	1631971
Available (CaCl2) pH	pH	7.79	1633151	7.90		7.76	7.78	7.57		1633151

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		AP7356		AP7358		AP7359		AP7361		AP7362		AP7363		
Sampling Date		2008/09/26 09:15		2008/09/26 10:30		2008/09/26 11:00		2008/09/26 11:45		2008/09/26 12:15		2008/09/26 12:30		
	Units	**BH-101-2**	**QC Batch**	**BH-103-1**	**QC Batch**	**BH-104-2**	**RDL**	**BH-106-1**	**RDL**	**BH-107-3**	**RDL**	**BH-108-1**	**RDL**	**QC Batch**
Metals														
Hot Water Ext. Boron (B)	ug/g	0.12	1632323	0.12	1632323	0.07	0.01	0.27	0.01	0.23	0.01	0.31	0.01	1632323
Chromium (VI)	ug/g	<0.2	1629105	<0.2	1628782	<0.2	0.2	<1(1)	1	<0.2	0.2	<1(1)	1	1629105
Acid Extractable Mercury (Hg)	ug/g	0.19	1631996	<0.05	1631996	<0.05	0.05	1.4	0.1	<0.05	0.05	0.16	0.05	1631996
Acid Extractable Antimony (Sb)	ug/g	<0.2	1631990	<0.2	1631990	<0.2	0.2	<0.2	0.2	<0.2	0.2	0.2	0.2	1631990
Acid Extractable Arsenic (As)	ug/g	10	1631990	5	1631990	5	1	3	1	4	1	7	1	1631990
Acid Extractable Barium (Ba)	ug/g	25	1631990	100	1631990	98	0.5	52	0.5	130	0.5	63	0.5	1631990
Acid Extractable Beryllium (Be)	ug/g	0.7	1631990	0.5	1631990	0.6	0.2	0.4	0.2	0.6	0.2	0.5	0.2	1631990
Acid Extractable Cadmium (Cd)	ug/g	<0.1	1631990	<0.1	1631990	<0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	1631990
Acid Extractable Chromium (Cr)	ug/g	15	1631990	17	1631990	18	1	13	1	21	1	18	1	1631990
Acid Extractable Cobalt (Co)	ug/g	13	1631990	9.4	1631990	11	0.1	6.8	0.1	11	0.1	10	0.1	1631990
Acid Extractable Copper (Cu)	ug/g	33	1631990	28	1631990	27	0.5	20	0.5	25	0.5	24	0.5	1631990
Acid Extractable Lead (Pb)	ug/g	17	1631990	7	1631990	7	1	12	1	11	1	62	1	1631990
Acid Extractable Molybdenum (Mo)	ug/g	0.6	1631990	<0.5	1631990	<0.5	0.5	<0.5	0.5	0.5	0.5	<0.5	0.5	1631990
Acid Extractable Nickel (Ni)	ug/g	25	1631990	21	1631990	22	0.5	15	0.5	25	0.5	21	0.5	1631990
Acid Extractable Selenium (Se)	ug/g	<0.5	1631990	<0.5	1631990	<0.5	0.5	0.6	0.5	<0.5	0.5	<0.5	0.5	1631990
Acid Extractable Silver (Ag)	ug/g	<0.2	1631990	<0.2	1631990	<0.2	0.2	<0.2	0.2	<0.2	0.2	<0.2	0.2	1631990
Acid Extractable Thallium (Tl)	ug/g	0.11	1631990	0.07	1631990	0.08	0.05	0.05	0.05	0.09	0.05	0.09	0.05	1631990
Acid Extractable Vanadium (V)	ug/g	16	1631990	25	1631990	26	5	15	5	27	5	19	5	1631990
Acid Extractable Zinc (Zn)	ug/g	61	1631990	49	1631990	51	5	39	5	63	5	110	5	1631990

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) - Due to colour interferences, sample required dilution. Detection limit was adjusted accordingly.

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

SEMI-VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		AP7359		
Sampling Date		2008/09/26 11:00		
	Units	**BH-104-2**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons				
Acenaphthene	ug/g	<0.01	0.01	1629683
Acenaphthylene	ug/g	<0.005	0.005	1629683
Anthracene	ug/g	<0.005	0.005	1629683
Benzo(a)anthracene	ug/g	<0.01	0.01	1629683
Benzo(a)pyrene	ug/g	<0.005	0.005	1629683
Benzo(b/j)fluoranthene	ug/g	<0.01	0.01	1629683
Benzo(g,h,i)perylene	ug/g	<0.02	0.02	1629683
Benzo(k)fluoranthene	ug/g	<0.01	0.01	1629683
Chrysene	ug/g	<0.01	0.01	1629683
Dibenz(a,h)anthracene	ug/g	<0.02	0.02	1629683
Fluoranthene	ug/g	<0.005	0.005	1629683
Fluorene	ug/g	<0.005	0.005	1629683
Indeno(1,2,3-cd)pyrene	ug/g	<0.02	0.02	1629683
1-Methylnaphthalene	ug/g	<0.005	0.005	1629683
2-Methylnaphthalene	ug/g	<0.005	0.005	1629683
Naphthalene	ug/g	<0.005	0.005	1629683
Phenanthrene	ug/g	<0.005	0.005	1629683
Pyrene	ug/g	<0.005	0.005	1629683
Surrogate Recovery (%)				
D10-Anthracene	%	78		1629683
D14-Terphenyl (FS)	%	74		1629683
D7-Quinoline	%	57		1629683
D8-Acenaphthylene	%	64		1629683

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

VOLATILE ORGANICS BY GC/MS (SOIL)

Maxxam ID		AP7356	AP7357	AP7358	AP7359	AP7360	AP7361	AP7362	AP7363		
Sampling Date		2008/09/26 09:15	2008/09/26 10:00	2008/09/26 10:30	2008/09/26 11:00	2008/09/26 11:15	2008/09/26 11:45	2008/09/26 12:15	2008/09/26 12:30		
	Units	**BH-101-2**	**BH-102-2**	**BH-103-1**	**BH-104-2**	**BH-105-1**	**BH-106-1**	**BH-107-3**	**BH-108-1**	**RDL**	**QC Batch**
Volatile Organics											
Benzene	ug/g	0.003	<0.002	0.005	0.003	0.004	0.009	0.005	0.004	0.002	1629394
Ethylbenzene	ug/g	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	1629394
Toluene	ug/g	0.004	0.002	0.008	0.008	0.008	0.007	0.008	0.007	0.002	1629394
p+m-Xylene	ug/g	<0.002	<0.002	0.008	0.005	0.005	0.003	0.006	0.004	0.002	1629394
o-Xylene	ug/g	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	1629394
Xylene (Total)	ug/g	<0.002	<0.002	0.008	0.005	0.005	0.003	0.006	0.004	0.002	1629394
Surrogate Recovery (%)											
4-Bromofluorobenzene	%	85	91	99	89	90	77	93	80		1629394
D4-1,2-Dichloroethane	%	94	97	93	82	78	34(1)	81	80		1629394
D8-Toluene	%	134	117	115	130	130	152(2)	107	121		1629394

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) - The recovery for the surrogate compound was below the control limit for duplicate analyses of the soil sample. This likely indicates the presence of a sample matrix effect. As a result, there is an increased level of uncertainty associated with the values reported for this sample.
(2) - The recovery for the surrogate compound was above the control limit for duplicate analyses of the soil sample. This likely indicates the presence of a sample matrix effect. As a result, there is an increased level of uncertainty associated with the values reported for this sample.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		AP7356	AP7357	AP7358	AP7359	AP7360	AP7361	AP7362	AP7363		
Sampling Date		2008/09/26 09:15	2008/09/26 10:00	2008/09/26 10:30	2008/09/26 11:00	2008/09/26 11:15	2008/09/26 11:45	2008/09/26 12:15	2008/09/26 12:30		
	Units	**BH-101-2**	**BH-102-2**	**BH-103-1**	**BH-104-2**	**BH-105-1**	**BH-106-1**	**BH-107-3**	**BH-108-1**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons											
F1 (C6-C10)	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	10	1628738
F1 (C6-C10) - BTEX	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	10	1628738
F2-F4 Hydrocarbons											
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	10	1628800
F3 (C16-C34 Hydrocarbons)	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	10	1628800
F4 (C34-C50 Hydrocarbons)	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	10	1628800
Reached Baseline at C50	ug/g	YES	YES	YES	YES	YES	YES	YES	YES		1628800
Surrogate Recovery (%)											
1,4-Difluorobenzene	%	111	106	113	108	107	107	107	111		1628738
4-Bromofluorobenzene	%	92	92	94	84	88	78	114	90		1628738
D10-Ethylbenzene	%	116	109	121	106	107	105	108	117		1628738
D4-1,2-Dichloroethane	%	97	94	101	103	97	98	47(1)	101		1628738
o-Terphenyl	%	84	83	86	78	78	82	81	88		1628800

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) - The recovery of the Instrument surrogate 1,2-Dichloroethane-D4 is outside the acceptance limits. However this has no significant effect on the results since the recovery of the other Instrument surrogate is within acceptable limits, and the sample is clean.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

GENERAL COMMENTS

F1BTEX Analysis: The BTEX results used for the F1-BTEX calculation were obtained from Headspace-GC analysis.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
1627382	Grain Size	2008/09/29							NC	20		
1627382	Sieve - #200 (<0.075mm)	2008/09/29							0.04	20		
1627382	Sieve - #200 (>0.075mm)	2008/09/29							0.4	20		
1627813	Moisture	2008/09/29							0.8	50		
1628738	1,4-Difluorobenzene	2008/09/30	104	60 - 140	101	60 - 140	104	%				
1628738	4-Bromofluorobenzene	2008/09/30	122	60 - 140	114	60 - 140	82	%				
1628738	D10-Ethylbenzene	2008/09/30	109	30 - 130	104	30 - 130	105	%				
1628738	D4-1,2-Dichloroethane	2008/09/30	93	60 - 140	91	60 - 140	92	%				
1628738	F1 (C6-C10)	2008/09/30	97	60 - 140	98	60 - 140	<10	ug/g	NC	50		
1628738	F1 (C6-C10) - BTEX	2008/09/30					<10	ug/g	NC	50		
1628782	Chromium (VI)	2008/10/01	102	75 - 125	101	75 - 125	<0.2	ug/g	NC (1)	35	100	85 - 115
1628800	o-Terphenyl	2008/10/01	97	30 - 130	92	30 - 130	84	%				
1628800	F2 (C10-C16 Hydrocarbons)	2008/10/01	88	60 - 130	87	60 - 130	<10	ug/g	NC	50		
1628800	F3 (C16-C34 Hydrocarbons)	2008/10/01	88	60 - 130	87	60 - 130	<10	ug/g	NC	50		
1628800	F4 (C34-C50 Hydrocarbons)	2008/10/01	88	60 - 130	87	60 - 130	<10	ug/g	NC	50		
1629105	Chromium (VI)	2008/10/01	95	75 - 125	98	75 - 125	<0.2	ug/g	NC	35	100	N/A
1629394	4-Bromofluorobenzene	2008/10/01	104	60 - 140	108	60 - 140	116	%				
1629394	D4-1,2-Dichloroethane	2008/10/01	83	60 - 140	94	60 - 140	94	%				
1629394	D8-Toluene	2008/10/01	108	60 - 140	100	60 - 140	114	%				
1629394	Benzene	2008/10/02	66	39 - 137	89	60 - 140	<0.002	ug/g	NC	50		
1629394	Ethylbenzene	2008/10/02	85	46 - 150	97	60 - 140	<0.002	ug/g	NC	50		
1629394	Toluene	2008/10/02	85	30 - 158	97	60 - 140	<0.002	ug/g	NC	50		
1629394	p+m-Xylene	2008/10/02	86	29 - 161	95	60 - 140	<0.002	ug/g	NC	50		
1629394	o-Xylene	2008/10/02	77	45 - 150	97	60 - 140	<0.002	ug/g	NC	50		
1629394	Xylene (Total)	2008/10/02					<0.002	ug/g	25.4	50		
1629683	D10-Anthracene	2008/09/30	84	30 - 130	83	30 - 130	81	%				
1629683	D14-Terphenyl (FS)	2008/09/30	77	30 - 130	80	30 - 130	77	%				
1629683	D7-Quinoline	2008/09/30	70	30 - 130	65	30 - 130	68	%				
1629683	D8-Acenaphthylene	2008/09/30	73	30 - 130	70	30 - 130	74	%				
1629683	Acenaphthene	2008/10/01	80	30 - 130	78	30 - 130	<0.01	ug/g	NC	50		
1629683	Acenaphthylene	2008/10/01	75	30 - 130	76	30 - 130	<0.005	ug/g	NC	50		
1629683	Anthracene	2008/10/01	82	30 - 130	82	30 - 130	<0.005	ug/g	NC	50		
1629683	Benzo(a)anthracene	2008/10/01	87	30 - 130	81	30 - 130	<0.01	ug/g	NC	50		
1629683	Benzo(a)pyrene	2008/10/01	102	30 - 130	98	30 - 130	<0.005	ug/g	7.0	50		
1629683	Benzo(b/j)fluoranthene	2008/10/01	95	30 - 130	87	30 - 130	<0.01	ug/g	0.9	50		
1629683	Benzo(g,h,i)perylene	2008/10/01	78	30 - 130	77	30 - 130	<0.02	ug/g	NC	50		
1629683	Benzo(k)fluoranthene	2008/10/01	95	30 - 130	95	30 - 130	<0.01	ug/g	NC	50		
1629683	Chrysene	2008/10/01	82	30 - 130	81	30 - 130	<0.01	ug/g	NC	50		
1629683	Dibenz(a,h)anthracene	2008/10/01	80	30 - 130	79	30 - 130	<0.02	ug/g	NC	50		
1629683	Fluoranthene	2008/10/01	86	30 - 130	81	30 - 130	<0.005	ug/g	10.1	50		

Maxxam Job #: A8B1533
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - SOIL/PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
1629683	Fluorene	2008/10/01	83	30 - 130	80	30 - 130	<0.005	ug/g	NC	50		
1629683	Indeno(1,2,3-cd)pyrene	2008/10/01	80	30 - 130	74	30 - 130	<0.02	ug/g	NC	50		
1629683	1-Methylnaphthalene	2008/10/01	68	30 - 130	67	30 - 130	<0.005	ug/g	NC	50		
1629683	2-Methylnaphthalene	2008/10/01	73	30 - 130	73	30 - 130	<0.005	ug/g	NC	50		
1629683	Naphthalene	2008/10/01	74	30 - 130	79	30 - 130	<0.005	ug/g	NC	50		
1629683	Phenanthrene	2008/10/01	87	30 - 130	82	30 - 130	<0.005	ug/g	20.9	50		
1629683	Pyrene	2008/10/01	80	30 - 130	78	30 - 130	<0.005	ug/g	9.4	50		
1631738	Free Cyanide	2008/10/03	103	75 - 125	102	75 - 125	<0.01	ug/g	NC	35		
1631971	Moisture	2008/10/02							8.1	50		
1631990	Acid Extractable Antimony (Sb)	2008/10/02	103	75 - 125			<0.2	ug/g	NC	35	97	75 - 125
1631990	Acid Extractable Arsenic (As)	2008/10/02	97	75 - 125			<1	ug/g	NC	35	103	75 - 125
1631990	Acid Extractable Barium (Ba)	2008/10/02	NC(2)	75 - 125			<0.5	ug/g	1.5	35	91	75 - 125
1631990	Acid Extractable Beryllium (Be)	2008/10/02	99	75 - 125			<0.2	ug/g	NC	35	101	75 - 125
1631990	Acid Extractable Cadmium (Cd)	2008/10/02	104	75 - 125			<0.1	ug/g	NC	35	93	75 - 125
1631990	Acid Extractable Chromium (Cr)	2008/10/02	104	75 - 125			<1	ug/g	10.3	35	88	75 - 125
1631990	Acid Extractable Cobalt (Co)	2008/10/02	94	75 - 125			<0.1	ug/g	13.2	35	93	75 - 125
1631990	Acid Extractable Copper (Cu)	2008/10/02	97	75 - 125			<0.5	ug/g	10.4	35	94	75 - 125
1631990	Acid Extractable Lead (Pb)	2008/10/02	99	75 - 125			<1	ug/g	5.8	35	97	75 - 125
1631990	Acid Extractable Molybdenum (Mo)	2008/10/02	100	75 - 125			<0.5	ug/g	NC	35	87	75 - 125
1631990	Acid Extractable Nickel (Ni)	2008/10/02	96	75 - 125			<0.5	ug/g	14.6	35	90	75 - 125
1631990	Acid Extractable Selenium (Se)	2008/10/02	95	75 - 125			<0.5	ug/g	NC	35	70	50 - 150
1631990	Acid Extractable Silver (Ag)	2008/10/02	107	75 - 125			<0.2	ug/g	NC	35	93	75 - 125
1631990	Acid Extractable Thallium (Tl)	2008/10/02	97	75 - 125			<0.05	ug/g	NC	35	87	75 - 125
1631990	Acid Extractable Vanadium (V)	2008/10/02	106	75 - 125			<5	ug/g	NC	35	94	75 - 125
1631990	Acid Extractable Zinc (Zn)	2008/10/02	NC	75 - 125			<5	ug/g	16.7	35	97	75 - 125
1631996	Acid Extractable Mercury (Hg)	2008/10/03	102	75 - 125			<0.05	ug/g	NC	35	102	75 - 125
1632323	Hot Water Ext. Boron (B)	2008/10/03					<0.01	ug/g			102	77 - 121
1633159	Conductivity	2008/10/03					<0.002	mS/cm	2.4	35	105	75 - 125

N/A = Not Applicable
NC = Non-calculable
RPD = Relative Percent Difference
(1) - Due to colour interferences, sample required dilution. Detection limit was adjusted accordingly.
(2) - The recovery in the matrix spike was not calculated (NC). Because of the high concentration of this analyte in the parent sample, the relative difference between the spiked and unspiked concentrations is not sufficiently significant to permit a reliable recovery calculation.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Validation Signature Page

Maxxam Job #: A8B1533

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

CUONG DUC DO, Senior Analyst, Semi-Volatiles

EWA PRANJIC, M.Sc., C.Chem, Scientific Specialist

MEDHAT RISKALLAH, Manager, Hydrocarbon Department

SUZANA POPOVIC, Supervisor, Hydrocarbons

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CAEAL have approved this reporting process and electronic report format.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

IMMEDIATE TEST

27-Sep-08 10:13
MELISSA MORRISON
A8B1533
DKN ENV-011

Maxxam Analytics

Maxxam Analytics International Corporation o/a Maxxam Analytics
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5779 www.maxxamanalytics.com

CHAIN OF CUSTO

Page 1 of 1

INVOICE INFORMATION:		REPORT INFORMATION (if differs from invoice):		PROJECT INFORMATION:		Only:
Company Name:	#2033 Aqua Terre Solutions Inc	Company Name:		Quotation #:	A85820	BOTTLE ORDER #: 96329
Contact Name:	Austin Sweezey	Contact Name:	Austin Sweezey/Thom Kewen	P.O.#:		
Address:	2 Gurdwara Rd Suite 200	Address:		Project #:	08-228D - SOIL	
	Nepean ON K2E 1A2			Project Name:	PWSAR	CHAIN OF CUSTODY #: C#96329-01-01
Phone:	(613)226-2456 Fax: (613)226-5529	Phone:	Fax:	Site Location:	Port Weller Search and Rescue	PROJECT MANAGER: MELISSA MORRISON
Email:	rasweezey@aquaterre.ca	Email:		Sampled By:	A.McIntosh	

REGULATORY CRITERIA:
- [ ] MISA — Reg. 153/04 — Sewer Use: [ ] Sanitary [ ] Storm [ ] Combined
- [ ] PWQO — [X] Table 1 [ ] Table 2
- [ ] Reg. 558 — [ ] Table 3 [ ] Table 6 — Municipality _____
- Other (specify) _____

SPECIAL INSTRUCTIONS
* note: 24 jars filled infield that were not submitted for analysis

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

ANALYSIS REQUESTED (Please be specific):

TURNAROUND TIME (TAT) REQUIRED:

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Regular (Standard) TAT: [X]
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission) [ ]
Date Required: _____ Time Required: _____
Rush Confirmation Number: _____ (call lab for #)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled / Time Sampled	Matrix	Regulated Drinking Water ? (Y/N)	Metals Field Filtered ? (Y/N)	O'Reg 153 Petroleum Hydrocarbons	PAH Compounds in Soil by GC/MS (SIM)	O'Reg 153 Metals & Inorganics Complete	pH CaCl2 EXTRACT	Sieve, 75um	pH				# of Bottles	Comments
1		BH-101-2	09:15 26Sept.08	Soil	-	-	X		X							3	
2		BH-102-2	10:00 26Sept.08	Soil	-	-	X			X	X					4	
3		BH-103-1	10:30 26Sept.08	Soil	-	-	X		X							3	
4		BH-104-2	11:00 26Sept.08	Soil	-	-	X	X	X							4	
5		BH-105-1	11:15 26Sept.08	Soil	-	-	X									2	
6		BH-106-1	11:45 26Sept.08	Soil	-	-	X		X							3	
7		BH-107-3	12:15 26Sept.08	Soil	-	-	X		X							3	
8		BH-108-1	12:30 26Sept.08	Soil	-	-	X		X							3	
9																	
10																	'08 SEP 27 10:13

*RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	Laboratory Use Only: Time Sensitive	Temperature (°C) on Receipt	Condition of Sample on Receipt	Custody Seal Intact on Cooler?
Alison McIntosh	08/09/26	17:00	DAVID CHAN	2008/09/27	10:13	X	1/2/3°C	[ ] OK [ ] SIF	[X] Yes [ ] No

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yellow: Client

Appendix H

Laboratory Certificates of Analysis (Water)

Your Project #: 08-228D - WATER PWSAR
Site: PORT WELLER SEARCH AND RESCUE
Your C.O.C. #: 96336-01

Attention: Austin Sweezey
Aqua Terre Solutions Inc
Nepean
20 Colonnade Road, Suite 110
Ottawa, ON
K2E 7M6

Report Date: 2008/10/06

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A8B1600
Received: 2008/09/27, 10:16

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Alkalinity	1	N/A	2008/10/03	CAM SOP-00448	SM 2320B
Carbonate, Bicarbonate and Hydroxide	1	N/A	2008/10/03		
Chloride by Automated Colourimetry	1	N/A	2008/10/03	CAM SOP-00463	SM 4500 Cl E
Conductivity	1	N/A	2008/10/03	CAM SOP-00448	SM 2510
Dissolved Organic Carbon (DOC)	1	N/A	2008/10/01	CAM SOP-00446	SM 5310 B
Hardness (calculated as CaCO3)	1	N/A	2008/10/03	CAM SOP 0102	SM 2340 B
Dissolved Metals by ICPMS	1	N/A	2008/10/02	CAM SOP-00447	EPA 6020
Ion Balance (% Difference)	1	N/A	2008/10/03		
Anion and Cation Sum	1	N/A	2008/10/03		
Ammonia-N	1	N/A	2008/10/03	CAM SOP-00441	US GS I-2522-90
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2008/10/01	CAM SOP-00440	SM 4500 NO3 I
pH	1	N/A	2008/10/03	CAM SOP-00448	SM 4500H
Orthophosphate	1	N/A	2008/10/03	CAM SOP-00461	SM 4500 P-F
Sat. pH and Langelier Index (@ 20C)	1	N/A	2008/10/03		
Sat. pH and Langelier Index (@ 4C)	1	N/A	2008/10/03		
Sulphate by Automated Colourimetry	1	N/A	2008/10/03	CAM SOP-00464	EPA 375.4
Total Dissolved Solids (TDS calc)	1	N/A	2008/10/03		

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

MELISSA MORRISON, Project Manager
Email: Melissa.Morrison@maxxamanalytics.com
Phone# (613) 274-0573

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CAEAL have approved this reporting process and electronic report format.

Maxxam Job #: A8B1600
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - WATER PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

For Service Group specific validation please refer to the Validation Signature Page

Total cover pages: 2

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1600
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - WATER PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

RESULTS OF ANALYSES OF WATER

Maxxam ID		AP7818		
Sampling Date		2008/09/26 08:15		
	Units	**PWSAR-SEPTEMBER 2008**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	18.1	N/A	1627064
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	198	1	1627061
Calculated TDS	mg/L	1090	1	1627239
Carb. Alkalinity (calc. as CaCO3)	mg/L	3	1	1627061
Cation Sum	me/L	18.3	N/A	1627064
Hardness (CaCO3)	mg/L	8	1	1627238
Ion Balance (% Difference)	%	0.520	N/A	1627063
Langelier Index (@ 20C)	N/A	-0.732		1627065
Langelier Index (@ 4C)	N/A	-0.977		1627066
Saturation pH (@ 20C)	N/A	8.99		1627065
Saturation pH (@ 4C)	N/A	9.23		1627066
Inorganics				
Total Ammonia-N	mg/L	0.34	0.05	1631130
Conductivity	umho/cm	2020	2	1631757
Dissolved Organic Carbon	mg/L	0.9	0.1	1630634
Orthophosphate (P)	mg/L	<0.01	0.01	1632376
pH	pH	8.3		1631754
Dissolved Sulphate (SO4)	mg/L	144	1	1632385
Alkalinity (Total as CaCO3)	mg/L	201	1	1631756
Dissolved Chloride (Cl)	mg/L	390	5	1632368
Nitrite (N)	mg/L	<0.01	0.01	1630297
Nitrate (N)	mg/L	<0.1	0.1	1630297
Nitrate + Nitrite	mg/L	<0.1	0.1	1630297

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1600
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - WATER PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		AP7818		
Sampling Date		2008/09/26 08:15		
	Units	**PWSAR-SEPTEMBER 2008**	**RDL**	**QC Batch**
Metals				
Dissolved Aluminum (Al)	ug/L	5	5	1632183
Dissolved Antimony (Sb)	ug/L	<0.5	0.5	1632183
Dissolved Arsenic (As)	ug/L	<1	1	1632183
Dissolved Barium (Ba)	ug/L	<5	5	1632183
Dissolved Beryllium (Be)	ug/L	<0.5	0.5	1632183
Dissolved Boron (B)	ug/L	1300	10	1632183
Dissolved Cadmium (Cd)	ug/L	<0.1	0.1	1632183
Dissolved Calcium (Ca)	ug/L	1900	200	1632183
Dissolved Chromium (Cr)	ug/L	<5	5	1632183
Dissolved Cobalt (Co)	ug/L	<0.5	0.5	1632183
Dissolved Copper (Cu)	ug/L	11	1	1632183
Dissolved Iron (Fe)	ug/L	<100	100	1632183
Dissolved Lead (Pb)	ug/L	<0.5	0.5	1632183
Dissolved Magnesium (Mg)	ug/L	680	50	1632183
Dissolved Manganese (Mn)	ug/L	<2	2	1632183
Dissolved Molybdenum (Mo)	ug/L	13	1	1632183
Dissolved Nickel (Ni)	ug/L	<1	1	1632183
Dissolved Phosphorus (P)	ug/L	<100	100	1632183
Dissolved Potassium (K)	ug/L	12000	200	1632183
Dissolved Selenium (Se)	ug/L	<2	2	1632183
Dissolved Silicon (Si)	ug/L	4900	50	1632183
Dissolved Silver (Ag)	ug/L	<0.1	0.1	1632183
Dissolved Sodium (Na)	ug/L	410000	1000	1632183
Dissolved Strontium (Sr)	ug/L	89	1	1632183
Dissolved Thallium (Tl)	ug/L	<0.05	0.05	1632183
Dissolved Titanium (Ti)	ug/L	<5	5	1632183
Dissolved Uranium (U)	ug/L	0.2	0.1	1632183
Dissolved Vanadium (V)	ug/L	<1	1	1632183
Dissolved Zinc (Zn)	ug/L	12	5	1632183

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1600
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - WATER PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
1630297	Nitrite (N)	2008/10/01	101	75 - 125	103	80 - 120	<0.01	mg/L	NC	25		
1630297	Nitrate (N)	2008/10/01	NC(1)	75 - 125	94	80 - 120	<0.1	mg/L	0.8	25		
1630297	Nitrate + Nitrite	2008/10/01					<0.1	mg/L	0.8	25		
1630634	Dissolved Organic Carbon	2008/10/01	NC(1)	75 - 125	106	75 - 125	0.2, RDL=0.1	mg/L	0.4	20		
1631130	Total Ammonia-N	2008/10/03	89	80 - 120	103	80 - 120	<0.05	mg/L	NC	25		
1631756	Alkalinity (Total as CaCO3)	2008/10/03					<1	mg/L	1.9	25	101	85 - 115
1631757	Conductivity	2008/10/03					<2	umho/cm	1.2	25	101	85 - 115
1632183	Dissolved Aluminum (Al)	2008/10/02	107	80 - 120	102	85 - 115	<5	ug/L	NC	25		
1632183	Dissolved Antimony (Sb)	2008/10/02	110	80 - 120	102	85 - 115	<0.5	ug/L	NC	25		
1632183	Dissolved Arsenic (As)	2008/10/02	105	80 - 120	99	85 - 115	<1	ug/L	NC	25		
1632183	Dissolved Barium (Ba)	2008/10/02	103	80 - 120	101	85 - 115	<5	ug/L	0.4	25		
1632183	Dissolved Beryllium (Be)	2008/10/02	107	80 - 120	102	85 - 115	<0.5	ug/L	NC	25		
1632183	Dissolved Boron (B)	2008/10/02	103	80 - 120	98	85 - 115	<10	ug/L	NC	25		
1632183	Dissolved Cadmium (Cd)	2008/10/02	109	80 - 120	103	85 - 115	<0.1	ug/L	NC	25		
1632183	Dissolved Calcium (Ca)	2008/10/02	NC(1)	80 - 120	100	85 - 115	<200	ug/L	3.3	25		
1632183	Dissolved Chromium (Cr)	2008/10/02	105	80 - 120	99	85 - 115	<5	ug/L	NC	25		
1632183	Dissolved Cobalt (Co)	2008/10/02	104	80 - 120	99	85 - 115	<0.5	ug/L	NC	25		
1632183	Dissolved Copper (Cu)	2008/10/02	101	80 - 120	97	85 - 115	<1	ug/L	NC	25		
1632183	Dissolved Iron (Fe)	2008/10/02	109	80 - 120	104	85 - 115	<100	ug/L	NC	25		
1632183	Dissolved Lead (Pb)	2008/10/02	104	80 - 120	99	85 - 115	<0.5	ug/L	NC	25		
1632183	Dissolved Magnesium (Mg)	2008/10/02	NC(1)	80 - 120	102	85 - 115	<50	ug/L	3.0	25		
1632183	Dissolved Manganese (Mn)	2008/10/02	108	80 - 120	102	85 - 115	<2	ug/L	NC	25		
1632183	Dissolved Molybdenum (Mo)	2008/10/02	108	80 - 120	100	85 - 115	<1	ug/L	NC	25		
1632183	Dissolved Nickel (Ni)	2008/10/02	103	80 - 120	98	85 - 115	<1	ug/L	NC	25		
1632183	Dissolved Phosphorus (P)	2008/10/02	114	80 - 120	102	85 - 115	<100	ug/L	NC	25		
1632183	Dissolved Potassium (K)	2008/10/02	105	80 - 120	101	85 - 115	<200	ug/L	1.9	25		
1632183	Dissolved Selenium (Se)	2008/10/02	105	80 - 120	99	85 - 115	<2	ug/L	NC	25		
1632183	Dissolved Silicon (Si)	2008/10/02	105	80 - 120	101	85 - 115	<50	ug/L	1.5	25		
1632183	Dissolved Silver (Ag)	2008/10/02	102	80 - 120	97	85 - 115	<0.1	ug/L	NC	25		
1632183	Dissolved Sodium (Na)	2008/10/02	107	80 - 120	103	85 - 115	<100	ug/L	2.3	25		
1632183	Dissolved Strontium (Sr)	2008/10/02	105	80 - 120	100	85 - 115	<1	ug/L	1.9	25		
1632183	Dissolved Thallium (Tl)	2008/10/02	104	80 - 120	99	85 - 115	<0.05	ug/L	NC	25		
1632183	Dissolved Titanium (Ti)	2008/10/02	104	80 - 120	99	85 - 115	<5	ug/L	NC	25		
1632183	Dissolved Uranium (U)	2008/10/02	107	80 - 120	101	85 - 115	<0.1	ug/L	NC	25		
1632183	Dissolved Vanadium (V)	2008/10/02	108	80 - 120	102	85 - 115	<1	ug/L	NC	25		
1632183	Dissolved Zinc (Zn)	2008/10/02	105	80 - 120	98	85 - 115	<5	ug/L	NC	25		
1632368	Dissolved Chloride (Cl)	2008/10/03	106	75 - 125	108	80 - 120	<1	mg/L	0.5	20		

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8B1600
Report Date: 2008/10/06

Aqua Terre Solutions Inc
Client Project #: 08-228D - WATER PWSAR
Project name: PORT WELLER SEARCH AND RESCUE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
1632376	Orthophosphate (P)	2008/10/03	98	75 - 125	102	80 - 120	<0.01	mg/L	NC	25		
1632385	Dissolved Sulphate (SO4)	2008/10/03	NC(1)	75 - 125	101	80 - 120	<1	mg/L	1.3	25		

N/A = Not Applicable
NC = Non-calculable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
(1) - The recovery in the matrix spike was not calculated (NC). Because of the high concentration of this analyte in the parent sample, the relative difference between the spiked and unspiked concentrations is not sufficiently significant to permit a reliable recovery calculation.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Validation Signature Page

Maxxam Job #: A8B1600

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

CHRISTINA NERVO, Scientific Services

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CAEAL have approved this reporting process and electronic report format.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Analytics

Maxxam Analytics International Corporation o/a Maxxam Analytics
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5779 www.maxxamanalytics.com

CHAIN OF CUSTODY RECORD

INVOICE INFORMATION:		REPORT INFORMATION (if differs from invoice):		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#2033 Aqua Terre Solutions Inc	Company Name:		Quotation #:	A85820	MAXXAM JOB #:	BOTTLE ORDER #: 96336
Contact Name:	Austin Sweezey	Contact Name:	Austin Sweezey/Thom Kewen	P.O. #:			
Address:	2 Gurdwara Rd Suite 200 Nepean ON K2E 1A2	Address:		Project #:	08-228D - WATER		
				Project Name:	PWSAR	CHAIN OF CUSTODY #:	PROJECT MANAGER:
Phone:	(613)226-2456 Fax: (613)226-5529	Phone:	Fax:	Site Location:	Port Weller Search and Rescue	C#96336-01-01	MELISSA MORRISON
Email:	rasweezey@aquaterre.ca	Email:		Sampled By:	A. McIntosh		

REGULATORY CRITERIA:
- ☐ MISA — Reg. 153/04 — Sewer Use: ☐ Sanitary ☐ Storm ☐ Combined
- ☐ PWQO — ☒ Table 1 ☐ Table 2 ☐ Table 3 ☐ Table 6
- ☐ Reg. 558 — Municipality _____
- Other (specify) _____

SPECIAL INSTRUCTIONS

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

27-Sep-08 10:16
MELISSA MORRISON
A8B1600
ABO ENV-965

TURNAROUND TIME (TAT) REQUIRED:

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: _____ Time Required: _____ ☐
Rush Confirmation Number: _____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled (Time Sampled)	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	RCAp - Comprehensive	# of Bottles	Comments
1		PWSAR-September 2008	08:15 26Sept.08	water	N	Y	X	3	
2									
3									
4									
5									
6									
7									
8									
9									'08 SEP 27 10:16
10									

*RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	Laboratory Use Only: Time Sensitive	Temperature (°C) on Receipt	Condition of Sample on Receipt	Custody Seal Intact on Cooler?
Allison McIntosh	08/09/26	09:00	DAVID CHAN	2008/09/27	10:16	X	3/3/2°C	☐ OK ☐ SIF	☒ Yes ☐ No

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yell...

NEW GARAGE, SUPPLEMENTARY GEOTECHNICAL INVESTIGATION

Englobe
Soils Materials Environment

Public Works and Government Services Canada

SEARCH AND RESCUE STATION (SAR) REVITALIZATION ST. CATHARINE, ONTARIO – NEW GARAGE

July 21, 2020

Supplementary Geotechnical Investigation

124-B-0017786-0-01-100-GE-R-0002-0A

DRAFT VERSION

Prepared by:

Qasim Cheema, P.Eng.
Geotechnical Engineer

Approved by:

Houshang Akbari, P.Eng.
Senior Geotechnical Engineer

Production Team

Client

PWGSC Project Manager	Kathryn Gould

Englobe Corp.

Project Manager	Houshang Akbari, Senior Geotechnical Engineer, P.Eng.
Project Engineer	Qasim Cheema, Geotechnical Engineer, P.Eng.
Drilling Technician	Syed Ahsan
Drafter	Mai Soufan

Revision and Publication Register		
Revision N°	**Date**	**Modification and/or Publication Details**
0A	2020-07-21	Draft Supplementary Geotechnical Report - Garage

Property and Confidentiality

Table of Contents

Tables

Appendixes

1 INTRODUCTION

Englobe Corp. has completed a supplementary geotechnical investigation for the proposed new garage being added as part of the new building addition at Search and Rescue Station (SAR) in St. Catharines, Ontario (hereinafter referred as to "Site"). A geotechnical investigation was previously conducted by Englobe dated Oct 16, 2019 for the new proposed building. The results of the previous factual investigation along with recommendations were summarized in an englobe report (124-B-0017786-0-01-100-GE-R-0001-01). This report will cover the investigation at the Garage section of the proposed new building only. Hence, this report should be read in conjunction with Englobe report 124-B-0017786-0-01-100-GE-R-0001-01

The purpose of this geotechnical investigation was to determine the general subsoil types and groundwater conditions within the Garage footprint and obtain samples for geotechnical laboratory examination and testing. The results of the geotechnical investigation have been summarized and recommendations developed for the proposed new garage addition including excavation and backfill considerations, temporary construction dewatering requirements and foundation considerations.

2 PROJECT METHODOLOGY

The geotechnical investigation for this project followed the procedure outlined in the following paragraphs.

Subsequent to obtaining service clearances and cut permits, two (2) boreholes (BH1-2020 and BH2-2020) were advanced to a depth of 5.2 meters below ground surface (mbgs) within the project limits. The locations of the boreholes are indicated on the attached Borehole Location Drawings (Appendix 1, Drawings 1 and 2) with the Borehole Logs provided in Appendix 2. The boreholes were drilled on July 8th, 2020 using continuous flight solid stem auger equipment supplied by Kodiak Drilling operated under the continuous supervision of an Englobe field technician.

Subsoil samples were recovered at regular intervals of depth using a 50 mm O.D. split-barrel sampler driven into the subsoil in accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). The recovered subsoil samples were visually examined in the field and then preserved and transported to the Englobe Toronto laboratory for examination and testing. Groundwater observations were carried out in the open boreholes upon completion of the field work. The boreholes were promptly backfilled upon completion of drilling in accordance with Ontario Regulation 903 (as amended).

In the laboratory, each soil sample was examined as to its visual and textural characteristics by the Project Engineer. Moisture content determinations were carried out on all granular base/subbase and subgrade soil samples.

The borehole locations were surveyed by Englobe using SOKKIA GRX2 GNSS Receiver GPS connected to MAGNET Enterprise network referenced to MTM Zone 10 (NAD27-74

Adjustment). A summary of the Boreholes coordinates, and elevations are summarized in Table 1.

Table 1 Summary of Boreholes Coordinates and Elevations

BOREHOLE NO.	COORDINATES, M		ELEVATION, MASL	BOREHOLE DEPTH, MBGS (ELEVATION, MASL)
	NORTHING	EASTING		
BH1-2020	4,788,378.389	327,597.282	79.5	5.2 (74.3)
BH2-2020	4,788,377.615	327,589.092	79.4	5.2 (74.2)

3 LABORATORY TESTING

Soil samples recovered during this investigation were preserved and transported to the Englobe Toronto laboratory for additional testing. Moisture content testing was completed on all recovered samples with the results plotted on the borehole logs attached in Appendix 2.

Two (2) representative samples were selected and tested to determine their gradation and hydrometer analysis. The same representative soil samples were tested for Atterberg limits. The complete laboratory test results are included in Appendix 3.

The soil samples will be stored for a period of three months from the date of reporting. After this time, they will be discarded unless arrangements are made for extended storage.

4 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

The approximate borehole locations are indicated on the attached Borehole Location Drawing in Appendix 1, with the Borehole Logs provided in Appendix 2. The general subsoil conditions are outlined briefly below.

4.1 TOPSOIL

Topsoil was encountered at borehole location BH2-2020. The average topsoil thickness was approximately 50 mm.

4.2 FILL (GRAVEL)

A granular fill layer composed of poorly graded gravel, trace sand was observed surficial at BH1-2020 with an approximate thickness of 100mm.

4.3 FILL (SILTY SAND to SILTY CLAY)

A cohesionless fill layer composed of Silty Sand was encountered in both boreholes below the topsoil or gravel base. This cohesionless fill layer was compact in compactness condition, having SPT 'N' value of 12 blows per 300 mm penetration. The in-situ moisture content of this material ranged from 12 to 13 (moist) percent.

The cohesionless fill layer was underlain by a cohesive fill composed of silty clay, some sand to sandy. The cohesive fill layer was soft to firm in consistency, having SPT 'N' values ranging from 4 to 7 blows per 300 mm of penetration. The in-situ moisture content of this material ranged from about 14 to 27 (moist to very moist) percent. The laboratory test result conducted in the cohesive fill layer are presented in Appendix 3. A summary of testing for this layer is briefly outlined in Table 2.

Table 2 Summary of Gradation Results – Fill

BOREHOLE NO.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES, %				ATTERBERG LIMITS, %		
		GRAVEL	SAND	FINES		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
				SILT	CLAY			
BH2-2020	SS2	0	6	32	62	38	19	19

4.4 SILT CLAY (CL)

The silty clay, some sand to sandy was encountered at both borehole locations below the Fill layer. Both boreholes were terminated within this layer. This cohesive layer was stiff in compactness condition, having SPT 'N' values ranging from 7 to 11 blows per 300 mm of penetration. The in-situ moisture content of this material ranged from about 14 to 26 (moist) percent. The laboratory test result is presented in Appendix 3.

A summary of testing for this layer is briefly outlined in Table 3 below.

Table 3 Summary of Gradation Results – Silty Clay

BOREHOLE NO.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES, %				ATTERBERG LIMITS, %		
		GRAVEL	SAND	FINES		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
				SILT	CLAY			
BH1-2020	SS4	2	13	46	39	24	15	9

4.5 GROUNDWATER CONDITION

Groundwater measurements conducted in the open boreholes and based on results from previous geotechnical investigations show that stabilized groundwater is encountered at depths in the range of 1.7 meters below ground surface (mbgs), elevations of 77.8 m. It

should be noted that the mean elevation of Lake Ontario around this area is approximately elevations of 74.8.

5 FOUNDATION CONSIDERATIONS

5.1 Shallow Foundation

Based on the results of our geotechnical investigation, it should be possible to employ conventional spread and strip footings on native soil to support the garage building. The design bearing capacity of the soil and corresponding depth are summarized in Table 4.

Table 4 Bearing Pressure for Settlement (SLS), Factored Ultimate Soil Bearing Pressure (ULS) and Corresponding Founding Level

BEARING PRESSURE FOR SETTLEMENT (SLS), FACTORED ULTIMATE SOIL BEARING PRESSURE (ULS) AND CORRESPONDING FOUNDING LEVEL		
DEPTH, mbgs (Elev)	SLS	ULS
2.0 (77.5)	75	113

Both the total and differential settlement resulting from loads not exceeding the allowable loads recommended herein are estimated to be 25 mm and 10 mm respectively.

The base of the foundation excavations must be inspected by a qualified geotechnical engineer prior to concrete pour in order to confirm soil bearing capacity.

All footings must be founded below frost depth of 1.2 m.

5.2 Deep Foundation

Another alternative is to deep foundation system such as helical piles. The advantage of this method is to reduce the amount excavated soil and dewatering.

Helical piles are suitable for supporting the proposed garage foundations. The shaft must be grouted within the soils to prevent buckling. The pile would need to be founded in stiff silty clay at 5.0 mbgs (Elev. 74.50). The recommended ULS and SLS bearing resistance for 300 mm diameter helix, founded at approximate elevation of 74.50 would be 120 kPa and 90 kPa respectively.

The contractor must monitor and check the torque values when installing the piles to confirm the bearing capacity of the pile has been achieved. The minimum pile spacing (centre to centre) is three times the diameter of helix.

Helical piles have slender shafts that offer limited resistance to lateral loads for vertically installed shafts. In order to increase the lateral capacity of the helical piers foundations the size of the helical piles can be increased by installing the piles with a grouted column to increase the effective width of the shaft. Alternatively battered helical piles can be installed to resist lateral forces.

It is recommended that the helical piles be designed and installed by experienced specialist contractors. The allowable pile capacity proposed above should also be further confirmed based on the contractor selected system and specific helical pile configuration to be used.

All helical pile caps should have a permanent earth cover of 1.2 m for frost protection. The drilling and installation of the piles should be supervised by a Geotechnical Engineer.

6 Floor Slab

Slab-on-grade construction may be employed for the new garage. After properly grading the subgrade soils and proof rolling the exposed surface to identify any soft spots or areas exhibiting excessive deflections, (any soft or spongy areas should be sub-excavated and backfilled with approved compacted granular material placed in uniform lifts not exceeding 200 mm loose thickness and compacted to 100 percent SPMDD), a moisture barrier consisting of an approximately 200 mm layer of clear crushed stone should be placed over the prepared subgrade. The 19 mm clear stone should be placed by rafting it in over the prepared subgrade, taking care at all times to mitigate potential disturbance to the subgrade from foot and traffic compaction.

The upper fill material is mainly sand/gravel with clay and some silt, this material is not considered frost susceptible. As a precautionary measure we recommend installing 50 mm thick rigid insulations below the 200 mm clear stone and covering about 500 mm of exposed foundation walls.

7 Earthquake considerations

The National Building Code (NBC) stipulates that a building should be designed to withstand a minimum live load due to earthquake.

The Canadian Foundation Engineering Manual (4th Edition) describes the equivalent static force procedures that can be used to calculate a design seismic base shear proportional to the weight of the building that is to be constructed.

As part of the previous investigation, a Multi-Channel Analysis of Surface Waves (MASW) investigation was conducted at the site by Geophysics GPR International Inc. (Geophysics GPR) on August 6th, 2019. As per the report dated October 4th, 2019 by Geophysics GPR, the average Vs value of 30 readings at the site is 368m/s +/-15% to 20%, with a maximum value of 399 m/s and a minimum value of 342 m/s. Based on the average Vs values determined by MASW method and table 4.1.8.4.A of the NBC, 2015 Edition. Based on the MASW results, seismic site response class “D” (180< Vs ≤ 360 m/s) can be used for earthquake load and effects in accordance with the NBC.

8 EXCAVATION AND BACKFILL CONSIDERATIONS

The investigation results suggest that the excavation should be able to carry out to the depth required for the underground services and shallow foundation construction using conventional excavation equipment. Excavation side slopes in the upper 3.5 mbgs are expected to remain relatively stable when they are cut back and maintained at an angle not steeper than 45 degrees (1H:1V sloped from the base of the excavation). In the event that wet seams or zones were encountered during the excavation, some sloughing to flatter slopes (as flat as 3H:1V) should be expected during construction. If steeper excavation are contemplated in the upper subsoils, they must be properly shored to temporarily support the excavation sidewalls and any surcharge loads that may be applied during the construction period. Regardless, all excavations must be carried out in accordance with the Ontario Occupational Health and Safety Act (OHSA). The subsoils encountered at the site, as per OHSA criteria, would typically be considered:

Moist to Very Moist, Compact, Silty Sand Fill– Type 4

Moist to Very Moist, Soft to Stiff, Silty Clay – Type 3

Soil that will be generated as result of excavations can be used as backfill material as long as it is maintained within 2% of its optimum moisture content level as determined by a Standard Proctor Maximum Dry Density (SPMDD) test.

The on-site soil can be used as engineer fill material provided its moisture content remains within two (2) percentage points of the optimum value. In the event imported soil is required to be used as engineered fill, it should be free of deleterious matter and its moisture content should be within 2 percentage points of optimum and the soil must comply with the residential/parkland property use criteria set in Table 8 of the “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act”; Ministry Of the Environmental, April 15, 2011.

The fill should be placed in loose lifts that do not exceed 200 mm in thickness, compacted at least 100 percent Standard Proctor Maximum Dry Density (SPMDD). This will require full time inspection by a qualified geotechnical inspector.

The zone of engineered fill placement should extend at least 1.0 m beyond the exterior edges of any exterior footings and should extend outward at a 45 degree angle to eliminate any edge effects on the bearing capacity that will be realised.

9 DEWATERING AND DRAINAGE CONSIDERATIONS

Groundwater measurements conducted the open boreholes as well as the previous investigation, indicates the stabilized water level at the site is 1.7 mbgs, elevations in order of 77.7 m. Therefore, dewatering will be necessary in order to pour the foundations.

10 GENERAL COMMENTS

The comments provided in this report have been developed for the use of Public Works and Government Services Canada. It should be noted that on the borehole logs, the soil boundaries indicated are inferred from non-continuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design. Also, the subsoil and groundwater conditions have been determined at the borehole location only.

The recommended bearing capacity has been calculated by Englobe from the information obtained from the borehole data.

It is further noted that, depending on the time of year the fieldwork was completed, water levels should be expected to vary, perhaps significantly, from those observed at the time of this investigation.

Appendix 1 Borehole Location Drawings

G:\124\B-0017786 PWAGSC, PORT WELLER, ST. CATHERINES\Z4_CAD\B-0017786-02-100\B-0017789-0-02_DWG.DWG

SITE LOCATION

NOTES :

1 - REFERENCES : Google Earth 2020

2 - Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

PORT WELLER - SEARCH AND RESCUE(SAR) STATION REVITALIZATION

ST. CATHARINES, ONTARIO

Title

SITE LOCATION PLAN

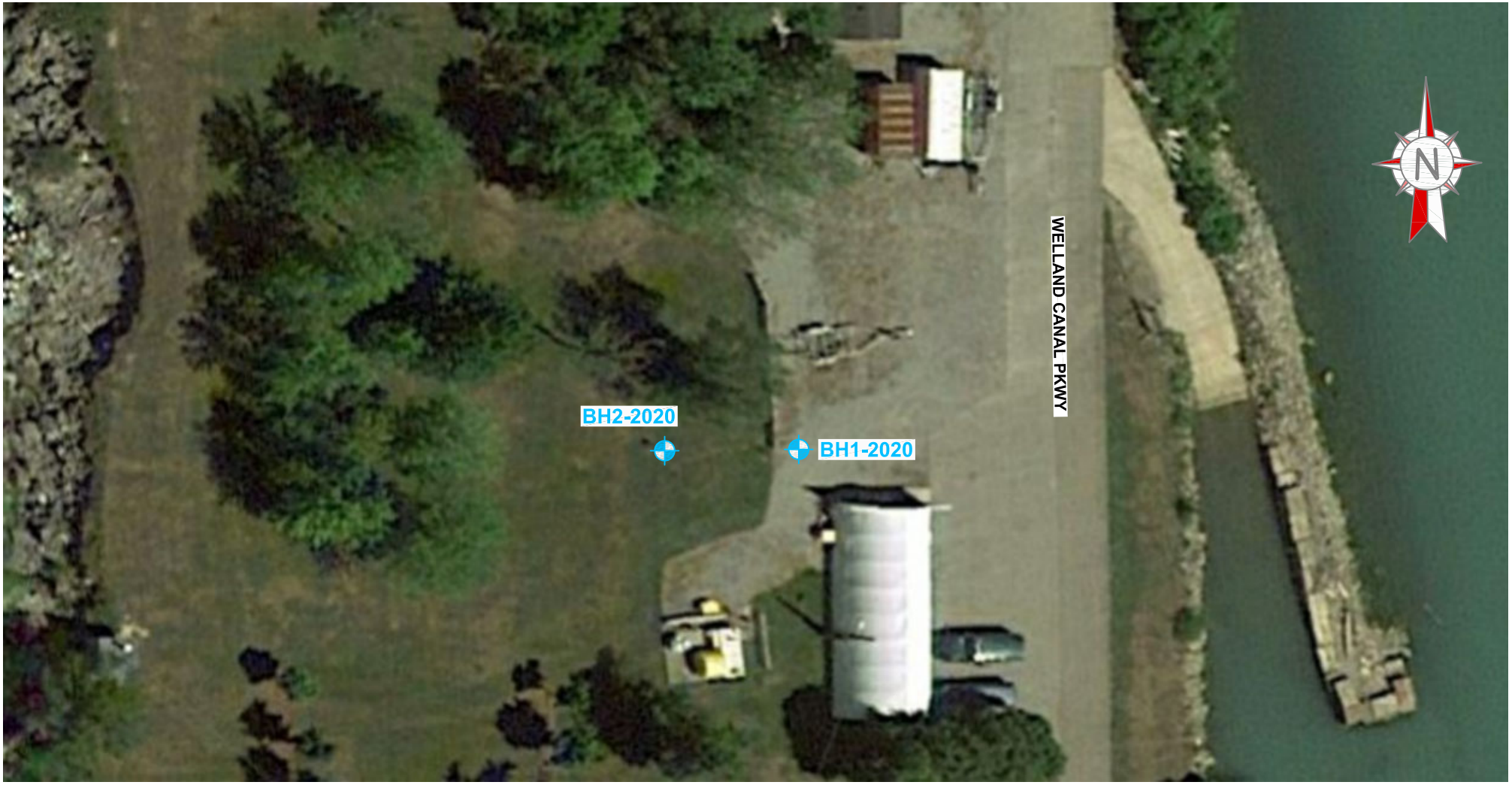
Englobe

1821, Albion Road, Unit 7
Toronto (Ontario) M9W 5W8
Telephone : 416.213.1060
Fax : 416.213.1070

Prepared	H. Akbari	Discipline	GEOTECHNICAL	Project manager	H. Akbari
Drawn	M. Soufan	Scale	N.T.S.	Sequence no.	01 of 02
Checked	H. Akbari	Date	2020/07/17		

M. dept.	Project	Work pckg.	Sub-w.p.	Disc.	Type	Drawing no.	Rev.
124	B-0017786	0-02	001	GE	D	02	00

G:\124\B-0017786 PWAGSC, PORT WELLER, ST. CATHERINES\Z4_CAD\B-0017786-02-100\B-0017789-0-02_DWG.DWG



BOREHOLE LOCATION (2020)

NOTES :

1 - REFERENCES : Google Earth 2020

2 - Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
PORT WELLER - SEARCH AND RESCUE(SAR) STATION REVITALIZATION

ST. CATHARINES, ONTARIO

Title

BOREHOLE/CORE LOCATION PLAN

GARAGE LOCATION

Englobe

1821, Albion Road, Unit 7
Toronto (Ontario) M9W 5W8
Telephone : 416.213.1060
Fax : 416.213.1070

Prepared	H. Akbari	Discipline	GEOTECHNICAL	Project manager	H. Akbari
Drawn	M. Soufan	Scale	N.T.S.	Sequence no.	01 of 02
Checked	H. Akbari	Date	2020/07/17		

M. dept.	Project	Work pckg.	Sub-w.p.	Disc.	Type	Drawing no.	Rev.
124	B-0017786	0-02	001	GE	D	02	00

Appendix 2 Borehole Logs

LOG OF No. BH1-2020

Englobe

Project No. B-0017786-0-01 DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR) Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,378 E 327,597

Date Drilled: 8/7/2020

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			79.5	0
		GRAVEL, trace sand (Granular Base/Subbase, 100 mm): brown, moist	79.4	
		FILL: silty sand, containing wood fragments, reddish brown, moist	78.8	
		FILL: silty clay, some sand, trace gravel, stiff, brown, moist to very moist		1
				2
		SILTY CLAY: some sand to sandy, trace gravel, stiff, brown to grey, moist SS4: Gr: 2%, Sa: 13%, Si: 46%, Cl: 39%	77.3	3
				4
			74.3	5
		Terminated at 5.2 m Borehole advanced using continuous flight of solid stem augering equipment on July 08, 2020 by Kodiak Drilling.		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
SAMPLES
Natural Unit Weight kN/m³

Checked By: H.Akbari

Logged By: Q.Cheema

Time	Water Level (m)	Depth to Cave (m)

LOG OF No. BH2-2020

Englobe

Project No. B-0017786-0-01 DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR) Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,378 E 327,589

Date Drilled: 8/7/2020

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			79.4	0
		TOPSOIL (50 mm)	79.4	
		FILL: silty sand, some gravel, containing wood fragments, compact, brown, moist	78.7	
		FILL: silty clay, trace sand to sandy, soft to firm, brown, moist SS2: Gr: 0%, Sa: 6%, Si: 32%, Cl: 62%	77.2	1
		SILTY CLAY: trace sand to sandy, trace gravel, stiff, brown to grey, moist	74.2	2
		Terminated at 5.2 m Borehole advanced using continuous flight of solid stem augering equipment on July 08, 2020 by Kodiak Drilling .		3
				4
				5

Standard Penetration Test N Value: 20, 40, 60, 80

Shear Strength kPa: 50, 100, 150, 200

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10, 20, 30

SAMPLES

Natural Unit Weight kN/m³

Time	Water Level (m)	Depth to Cave (m)

Checked By: H.Akbari

Logged By: Q.Cheema

LOG A GWWL02_ENGLOBE P-0017786-0-01 BOREHOLE LOGS-2020-07-15.GPJ LOG A GWGL02.GDT 21/7/20

Appendix 3 Geotechnical Testing Results

Englobe
1821 Albion Road, Unit 7 Toronto (Ontario) M9W 5W8
T 416.213.1060 | F 416.213.1070
toronto@englobecorp.com | www.englobecorp.com

GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT
MTO LS-602, 702, AND 703/704

PROJECT: B-0017786-02 CLIENT/JOB NAME: Public Works & Government Services CONTRACT NUMBER: -

ROS ID: 91296 PROJECT/LOCATION: Geotechnical Investigation Services/ 4 Welland Pkwy, Port Weller

SAMPLING LOCATION:	BH1 SS4
SAMPLING DEPTH, m	2.3m - 2.9m
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	S.A. Englobe Corp
SAMPLE DESCRIPTION:	sandy silty clay, trace gravel
SAMPLING DATE:	2020-07-10
SAMPLE RECEIVED DATE:	2020-07-10
GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	1.7
% SAND (75 µm to 4.75 mm):	13.2
% Silt (5 µm to 75 µm):	46.2
% Clay (<5 µm):	38.9
SUSCEPTIBILITY TO FROST HEAVING:	Moderate

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	70.0
37.5	100.0	0.026	63.7
26.5	100.0	0.017	57.3
19.0	100.0	0.010	49.5
13.2	100.0	0.007	43.6
9.5	100.0	0.005	38.9
4.75	98.3	0.003	33.3
2.36	96.2	0.001	23.5
1.18	95.4	ATTERBERG LIMITS, %	
0.60	94.3		
0.30	92.8	Plastic Limit	14.8
0.15	90.0	Liquid Limit	24.2
0.075	85.1	Plastic Index	9.4

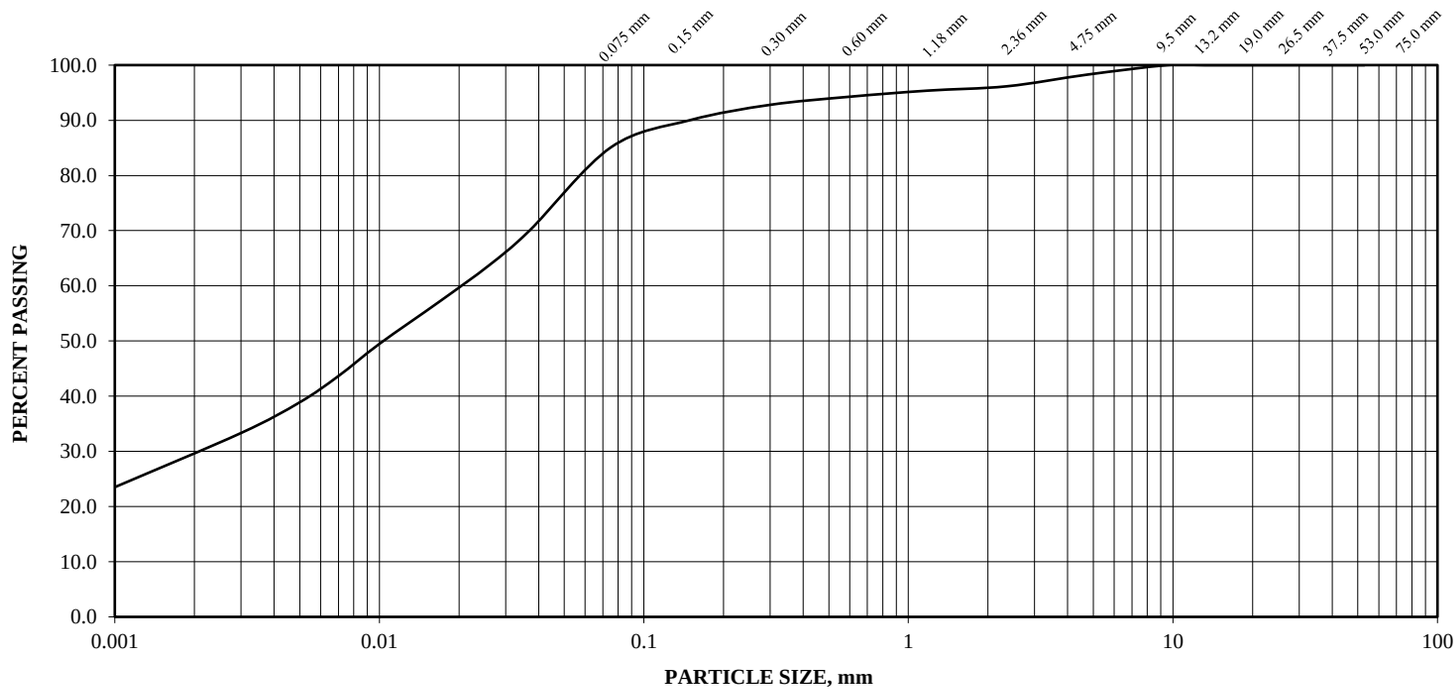
PARTICLE SIZE DISTRIBUTION, MTO LS-702

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



Englobe
1821 Albion Road, Unit 7 Toronto (Ontario) M9W 5W8
T 416.213.1060 | F 416.213.1070
toronto@englobecorp.com | www.englobecorp.com

GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT
MTO LS-602, 702, AND 703/704

PROJECT: B-0017786-02 CLIENT/JOB NAME: Public Works & Government Services CONTRACT NUMBER: -

ROS ID: 91296 PROJECT/LOCATION: Geotechnical Investigation Services/ 4 Welland Pkwy, Port Weller

SAMPLING LOCATION:	BH2 SS2
SAMPLING DEPTH, m	0.8m - 1.4m
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	S.A. Englobe Corp
SAMPLE DESCRIPTION:	silty clay, trace sand
SAMPLING DATE:	2020-07-10
SAMPLE RECEIVED DATE:	2020-07-10

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	0.2
% SAND (75 µm to 4.75 mm):	6.0
% Silt (5 µm to 75 µm):	32.1
% Clay (<5 µm):	61.7
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	88.2
37.5	100.0	0.026	83.8
26.5	100.0	0.017	79.3
19.0	100.0	0.010	72.3
13.2	100.0	0.007	66.8
9.5	100.0	0.005	61.7
4.75	99.8	0.003	53.9
2.36	99.3	0.001	37.5
1.18	98.8	ATTERBERG LIMITS, %	
0.60	98.0		
0.30	97.1	Plastic Limit	18.5
0.15	95.7	Liquid Limit	37.9
0.075	93.8	Plastic Index	19.4

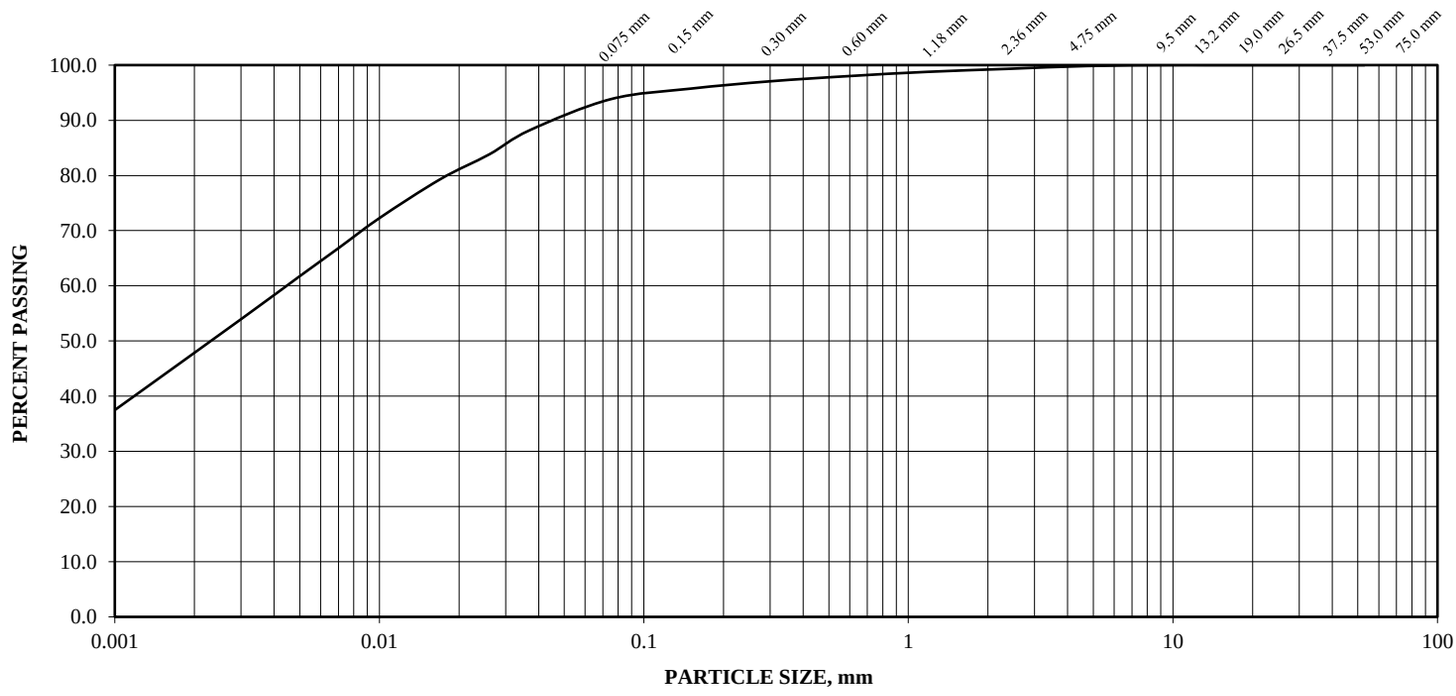
PARTICLE SIZE DISTRIBUTION, MTO LS-702

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



APPENDIX B

1. Mitigation Measures and Report Form, Port Weller Search and Rescue Station, St. Catharines, Ontario.

2. CCGC 13-2020, COVID-19 Canadian Coast Guard Screening Questionnaire.

MITIGATION MEASURES CHECKLIST

MITIGATION MEASURES CHECKLIST, PORT WELLER SEARCH AND RESCUE STATION, ST. CATHARINES, ONTARIO

Table 1: Mitigation Measures Checklist

No.	Mitigation Item to be Implemented	Compliance Y/N	If NO, Reason for Non-Compliance
1	Work must be scheduled to avoid periods of heavy precipitation.		
2	Noise restrictions for construction equipment in the City of St. Catharines "By-law to Prohibit and Regulate Noise – No. 95-198, as amended" must be followed.		
3	Gravel/paved areas are expected to be used for project staging/laydown and vehicles and other equipment involved in the construction will travel along paved access routes.		
4	Vehicles and machinery must be in good working order, well maintained, and operate according to the manufacture's specifications.		
5	Restrict the movement of vehicles and machinery to the work areas and designated access points. Movement over exposed soil is to be minimized.		
6	Tracking of mud/soil outside of the work site limits is to be minimized at entrance and exit of equipment decontamination pad.		
7	Ensure that non-contaminated construction garbage is removed daily from the work area and disposed in appropriate waste containers.		
8	If any debris/material, (e.g., plastic, food scraps, etc.) enter the aquatic environment they must be removed immediately and disposed of in a provincially approved manner.		
9	Dust suppression techniques must be applied which includes work reduction during high winds.		
10	Erosion control structures (temporary silt fencing, silt curtains, geotextile filter fabric) are to be used, as appropriate, to prevent erosion and release of sediments and/or sediment laden water during the construction phase and inspected daily.		
11	Water quality in potable water well must not be affected from on-site activities. This includes monitoring potable water geochemistry during earthwork activities and providing a comparative analysis if changes are observed.		
12	Remedial activities must be conducted by a qualified contractor to meet regulations, per the Project – specific Health and Safety Plan.		
13	Excavated soil must be removed, transported and disposed in accordance with applicable provincial legislation.		
14	The contractor must have the appropriate containment, spill kit, and clean up equipment on-site,		
15	Visual inspections must be conducted daily in order to determine if terrestrial wildlife or bird species are on the Site. To protect migratory birds, the removal of on-site shrubs or trees should occur outside of the period extending from the beginning of April to the end of August. The feeding, enticement, or harassment of all wildlife is prohibited.		
16	The Ontario Ministry of Natural Resources and Forestry (MNFR) and/or Environment Canada should be contacted if a SAR is observed within the Site during Project activities and standard protocol should be performed. Federal designations of SAR are listed under Schedule 1 of *SARA*.		
17	Cultural Heritage resources are to be protected. This includes elements of the former Lighthouse Keeper's dwelling and the Search and Rescue Station. Should other un-recorded cultural heritage values (archaeological or historical features) be identified during construction, all work activities shall be suspended in the vicinity of the discovery and Parks Canada Agency (PCA) shall be contacted.		

END OF SECTION

COVID-19 CANADIAN COAST GUARD SCREENING QUESTIONNAIRE

Annex I COVID-19 Canadian Coast Guard Screening Questionnaire

PROTECTED B (WHEN COMPLETED)

Privacy Notice Statement

As per Personal Information Bank Occupational Health and Safety - PSE 907, personal information is collected under the authority of sections 124 and 125 of the Canada Labour Code for the purpose of screening people prior to accessing a Coast Guard facility or vessel to ensure the health and safety of personnel. It may be used for contact tracing and disclosed to the Public Health Agency of Canada and/or provincial/territorial/local health authorities. Failure to provide this information may result in your entry being denied. Respondent verbally consents to the disposal of their personal information 30 days after the questionnaire is completed. In the case of individuals joining a vessel prior to deployment, forms will be disposed after 2 full crew cycles. You have the right to the correction of, access to, and protection of your personal information under the Privacy Act and to file a complaint with the Privacy Commissioner of Canada over CCG/DFO's handling of your information.

This screening questionnaire must be completed **daily** for any person seeking to gain access to a Canadian Coast Guard (CCG) facility or vessel.

Individuals must answer all questions honestly and should not attempt to enter a CCG facility or vessel if they have COVID-19 symptoms (including a fever, cough, or respiratory problems).

Questions asked at the initial CCG entry point	Response Yes / No	
1. Have you travelled outside of Canada in the last 14 days, or been in close contact (less than 2 metres) with someone who recently travelled outside of Canada? (If yes, deny access)		
2. Have you been in close contact (less than 2 metres) with anyone with COVID-19 symptoms or known COVID-19 positive person in the last 14 days where appropriate PPE has not been donned? (If yes, deny access)		
3. Are you experiencing a sudden onset of the following symptoms which may be attributed to COVID-19 rather than for example seasonal allergies or a known medical condition: • chills or muscle aches • cough • sore throat • runny nose • headache (If yes to **2 or more** unexplained symptoms, deny access)		
4. a) Please note that taking acetaminophen (e.g.Tylenol) or ibuprofen (e.g. Advil, Motrin) may reduce body temperature and mask the symptoms attributed to COVID-19. b) Temperature verified (indoors or in a warm vehicle) at point of entry:___°C (If temperature is greater than **37.5°C**, deny access)		
CCG employees who are denied access, must immediately report the circumstance to their superior and be referred to provincial health authorities for COVID-19 screening and a recommendation related to a defined period of self-isolation as may be necessary in accordance with provincial criteria.		

CCG facility or vessel name: _____

Date: _____

Name of employee (or guest): _____

Based on the responses to the questions posed above, access is:

Accepted_____ / Denied_____

Name of screening officer: _____

Signature of screening officer: _____

APPENDIX C

01 35 13.43	SPECIAL PROJECT PROCEDURES FOR CONTAMINATED SITES
01 35 43	ENVIRONMENTAL PROCEDURES
01 35 46	INDOOR AIR QUALITY PROCEDURES
01 74 20	CONSTRUCTION WASTE MANAGEMENT
02 81 01	HAZARDOUS MATERIALS
02 82 00.01	ASBESTOS MINIMUM PRECAUTIONS
02 82 00.02	ASBESTOS INTERMEDIATE PRECAUTIONS
02 82 00.03	ASBESTOS MAXIMUM PRECAUTIONS
02 83 10	MINIMUM LEAD ABATEMENT SPECS
02 83 11	INTERMEDIATE LEAD ABATEMENT SPECS
02 83 12	MAXIMUM LEAD ABATEMENT SPECS

PART 1 - GENERAL

1.1 REFERENCES

.1 Transportation and Dangerous Goods Act (1999).

.2 Canadian Council of Ministers of the Environment (CCME) Documentation.

.3 CCME Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment, Volumes 1 – 4 (2016)

.4 CCME Canadian Soil Quality Guidelines (CSQG) for the Protection of Environmental and Human Health

.5 Health Canada Guidelines for Canadian Drinking Water Quality, June, 2019.

.6 Ministry of the Environment, Conservation and Parks (MECP) Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011

.7 OPSS.PROV 1010 April 2013, Material Specification for Aggregates - Base, Subbase, Select subgrade, and Backfill Material

.8 Laboratory analyses completed by a Canadian Association for Laboratory Accreditation (CALA) certified laboratory

.9 Rules for Soil Management and Excess Soil Quality Standards (MECP, 2019)

1.2 REGULATORY REQUIREMENTS

.1 References:
- .1 Ontario Regulation 347, General – Waste Management.
- .2 Ontario Regulation 351/12, Registrations under Part II.2 of the Act – Waste Management Systems.
- .3 Ontario Regulation 170/03, Drinking Water Systems.
- .4 Ontario Regulation 406/19, On-Site and Excess Soil Management.
- .5 Environmental Protection Act, Revised Statutes of Ontario 1990, Chapter E19 as amended.
- .6 Canadian Environmental Protection Act (1999).

.2 Comply with federal, provincial, and local anti-pollution laws, ordinances, codes, and regulations when disposing of waste materials, debris, and rubbish.

.3 Work to meet or exceed minimum requirements established by federal, provincial, and local laws and regulations which are applicable.
- .1 Contractor: responsible for complying with amendments as they become effective.

.4 In event that compliance exceeds scope of Work or conflicts with specific requirements of contract notify Departmental Representative immediately.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Submittals for Progress Meetings: make submittals at least 24 hours prior to scheduled progress meetings as follows:
.1 Updated progress schedule detailing activities. Include review of progress with respect to previously established dates for starting and stopping various stages of Work, major problems and action taken, injury reports, equipment breakdown, and material removal.
.2 Copies of transport manifests, trip tickets, and disposal receipts for waste materials removed from Work areas.
.3 Weekly copies of site entry and Work area logbooks with information on worker and visitor access.
.4 Equipment Decontamination and inspections records in accordance with Subsection 1.7.12.
.5 Other information required by Departmental Representative or relevant to agenda for upcoming progress meeting.

.3 Site Layout Plan: within 7 days after date of Contract Award and prior to mobilization to site, submit site layout drawings showing existing conditions and facilities, construction facilities and temporary controls provided by Contractor including following:
.1 Truck and vehicle routes, entrances and exits to the Work Sites are to be identified and documented prior to the initiation of construction Work at the respective Work Areas.
.2 Equipment and material staging areas.
.3 Equipment and personnel decontamination areas.
.4 Water storage tanks.
.5 Imported clean backfill stockpiling areas.

.4 Underground Utilities Locates and Utility Protection Plan: submit public and private utilities locates and utility protection plan to Departmental Representative a minimum of 3 business days prior to commencement of intrusive Work.

.5 Equipment Decontamination Pad: submit equipment decontamination pad design to Departmental Representative for review prior to commencing construction.

.6 Water Well Monitoring and Sampling: Groundwater depth measurements and laboratory certificates of analysis for groundwater sampling outlined in Subsection 1.8, submitted to Departmental Representative within 24 hours of receipt of analytical results from the laboratory. Guideline exceedances must be clearly identified on the laboratory certificates of analysis

.7 Soil Disposal Facility: Written confirmation that a MECP licensed soil disposal facility will accept excavated material from the site as outlined in Subsection 1.9.2, submitted to and accepted by Departmental Representative 10 business days prior to commencing construction.

.8 Soil Disposal Documentation: Weigh scale tickets for excavated materials sent to and received by a disposal facility authorized by MECP for the Province of Ontario, as outlined in Subsection 1.9.2, submitted to Departmental Representative within 5 business days of removal of excavated

material from the site.

.9 HWIN registration (O. Reg. 347 - Ontario Generator Number) as outlined in Subsection 1.11.7, submitted to Departmental Representative at least 10 business days prior to commencing construction.

.10 Liquid Waste Disposal Documentation: Waste manifests for liquid wastes removed from the site as outlined in Subsection 1.11.7, submitted to Departmental Representative within 5 business days of removal of liquid waste from the site.

.11 Backfill quality: 10 business days prior to commencing construction, submit laboratory certificates of analysis to Departmental Representative in accordance with Subsection 1.10.5.

1.4 SEQUENCING AND SCHEDULING

.1 Do not commence Work involving contact with potentially contaminated materials until decontamination facilities are operational and approved by Departmental Representative.

1.5 EQUIPMENT DECONTAMINATION FACILITY

.1 Prior to commencing Work involving equipment contact with potentially contaminated materials, construct equipment decontamination pad to accommodate largest piece of on-site potentially contaminated equipment.

.2 Design and construct equipment decontamination pad on paved surface including an underlying continuous impermeable barrier that is resistance to the identified contaminants and subject to the approval of the Departmental Representative.

.3 Provide, operate, and maintain suitable portable, high-pressure, low-volume decontamination wash units capable of providing nozzle pressure of 10.34 MPa.

.4 Provide, operate, and maintain necessary equipment, pumps, and piping required to collect and contain equipment decontamination wastewater and sediment and transfer materials to approved storage facilities.

1.6 EQUIPMENT DECONTAMINATION

.1 Commence Work involving equipment contact with potentially contaminated material only after Equipment Decontamination Facility is operational.

.2 Decontaminate equipment after working in potentially contaminated Work areas and prior to subsequent Work or travel on clean areas.

.3 Perform equipment decontamination on Contractor-constructed equipment decontamination pad.

.4 At minimum, perform following steps during equipment decontamination: mechanically remove packed dirt, grit, and debris by scraping and brushing without using steam or high-pressure water to reduce amount of water needed and to reduce amount of contaminated rinsate generated. Use high-pressure,

low-volume, hot water or steam supplemented by detergents or solvents as appropriate and as approved by Departmental Representative. Pay particular attention to tire treads, equipment tracks, springs, joints, sprockets, and undercarriages. Scrub surfaces with long handle scrub brushes and cleaning agent. Rinse off and collect cleaning agent. Air dry equipment before removing from site or travelling on clean areas.

.5 Each piece of equipment will be inspected by Departmental Representative after decontamination and prior to removal from site and/or travel on clean areas. Departmental Representative will have right to require additional decontamination to be completed if deemed necessary.

.6 Take appropriate measures necessary to minimize drift of mist and spray during decontamination including provision of wind screens.

.7 Collect decontamination wastewaters and sediments which accumulate on equipment decontamination pad. Transfer wastewaters with a vac truck for disposal off-site at a licensed facility.

.8 Transfer sediments to disposal transport vehicle.

.9 Dispose of equipment decontamination sediment at an approved and licensed disposal facility.

.10 Furnish and equip personnel engaged in equipment decontamination with protective equipment including suitable disposable clothing, respiratory protection, and face shields.

.11 Have on hand sufficient pumping equipment, of adequate pumping capacity and associated machinery and piping in good working condition for ordinary emergencies, including power outage, and competent workers for operation of pumping equipment. Maintain piping and connections in good condition and leak-free.

.12 Maintain inspection records on-site which include equipment description and identification numbers/license plates; time and date of decontamination; name of inspector with comment stating that decontamination was performed and completed.

.13 Final Decontamination: Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from site.

.14 Decontamination pad shall be removed prior to conclusion of the project.

1.7 GROUNDWATER MONITORING

.1 Refer to Project Effects Determination report (Arcadis, 2018), Appendix A.

.2 Contractor: responsible for collecting groundwater level and water quality samples from the existing potable well on site prior to and during construction to ensure construction activities are not adversely affecting the well due to agitation and vibration during construction.

.3 Timing: The following tasks are to be completed by the Contractor 1) prior to commencement of Work; and 2) biweekly during construction.

.1 Measure depth to groundwater from top of well casing using a clean and disinfected water level tape provided by the Contractor.

.2 Collect a raw water sample from the well and submit to a Canadian Association of Laboratory Accreditation (CALA)certified analytical laboratory on a 1-day turnaround time for analysis of turbidity, colour, total dissolved solids, total suspended solids, and metals parameters listed in O. Reg. 170/03, Schedule 23 – Inorganic Parameters.

.3 Collect samples in accordance with O. Reg. 170/03 prior to any treatment systems that may be installed.

.4 Store, label and transport samples under chain of custody procedures in accordance with sampling protocols outlined in CCME Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment, Volumes 1 - 4, 2016

.5 Compare analytical results to the most recent version of the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada). In the absence of federal guidelines for a particular parameter, a guideline / standard / criteria from a different jurisdiction may be considered upon prior written approval from the Departmental Representative.

1.8 EXCAVATED SOIL SAMPLING, MANAGEMENT AND DISPOSAL

.1 Contractor to excavate to elevations and dimensions as required for construction and demolition purposes as specified to perform the Work. Soil is not to be removed beyond the limits specified. Additional soil removed outside of what is required to complete the Work will be considered outside the scope of Work and will be removed from the site at the Contractor’s expense.

.2 Contractor to direct haul all excavated material and drill cuttings off-site and dispose of at the MECP licensed soil disposal facility able to accept metal impacted soil, in accordance with applicable federal and provincial regulations and accepted by the Departmental Representative.

.3 Soil removal and off-site disposal shall be completed by the Contractor and supervised by the Departmental Representative

.4 Stockpiling of excavated soil and drill cuttings is not permitted on site.

.5 Contractor to dispose of all excavated soil and drill cuttings in accordance with O. Reg. 347 and O. Reg. 406/19.

.6 Excavated soil and drill cuttings to be transported by a registered waste management system in accordance with O. Reg. 351/12 and O. Reg. 347.

.7 Contractor to facilitate and provide access to soil in excavations to the Departmental Representative for sampling purposes, if required, as directed by the Departmental Representative.

1.9 BACKFILL REQUIREMENTS, MANAGEMENT AND SAMPLING

.1 Excavations must be backfilled with clean imported fill. Re-use of

excavated material as backfill is prohibited.

.2 Excavations must be dry prior to backfilling.

.3 In addition to other requirements, backfill must meet the following environmental quality standards:
.1 CCME Canadian Soil Quality Guidelines (CSQG) for the Protection of Environmental and Human Health, Tier 1 generic guidelines, residential land use; or, where no CSQG exists, MECP Table 8: Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Groundwater Condition, Residential Property Use, in Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011
.2 Free from roots, rocks larger than 75 mm and debris.

.4 Exception: Granular B, Type II aggregate material, defined under OPSS.PROV 1010, Material Specification for Aggregates - Base, Subbase, Select subgrade, and Backfill Material, will not be subject to analytical chemistry testing, but must be accepted by the Departmental Representative prior to shipment to site.

.5 Contractor to provide proof of environmental quality of the source of clean imported backfill. Samples of each backfill source are to be collected under the supervision of a Qualified Person (QP), as defined under O. Reg. 153/04, at a frequency of 3 samples per source, and 1 sample per 160 m^3 thereafter.

.6 Contractor to submit samples of backfill material for laboratory analysis of petroleum hydrocarbons fractions F1 to F4 (PHCs), benzene, toluene, ethylbenzene, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and CCME metals and inorganics parameters.

.7 Contractor to ensure backfill material is not contaminated during transport to the Work area.

.8 Quality assurance testing of imported backfill materials brought on-site to be completed by the Departmental Representative. Contractor to assist Departmental Representative with sample collection, if required.

.8 Backfill material must be approved for use by Departmental Representative prior to final placement.

.9 Stockpile backfill on a geotextile or geomembrane (Terrafix 270R or 6 mil poly or equivalent). Stockpile height not to exceed 2 m, sides sloped at 2:1 or flatter. Stockpiled material must be covered, to the satisfaction of the Departmental Representative, with an impermeable cover at all times when not in active use.

.10 Stockpile backfill materials in areas as indicated on Site Layout Plan and accepted by Departmental Representative.

.12 Backfill material delivered to the Work area that does not meet the environmental requirements must be returned to the original source site or disposed of at the MECP licensed soil disposal facility accepted by the Departmental Representative. Removal and disposal costs will be at the Contractor's expense. No extension of time will be granted for delivery of backfill material that does not meet requirements.

.13 If backfill does not meet the environmental requirements, subsequent testing and inspection costs by Departmental Representative on replacement backfill to be incurred by Contractor.

.14 Prior to placement of clean backfill as described in the specifications, Contractor to place a geotextile liner in the trench/excavation to demarcate clean backfill from pre-existing soil. The geotextile shall cover the floor and sidewalls of the excavation. Cut geotextile to 0.15 m below grade.

1.10 DEWATERING AND WATER MANAGEMENT

.1 Maintain excavations free of water. Provide, operate, and maintain necessary equipment appropriately sized to keep excavations, staging pads, and other Work areas free from water.

.2 Contain and collect wastewaters from decontamination pad.

.3 Provide, operate, and maintain water storage tanks to store wastewater from equipment decontamination and dewatering. Install water storage tanks in locations presented on Site Layout Plan, approved by Departmental Representative.

.4 Do not discharge impacted waters to ground surface, waterways, site ditches or sewer systems.

.5 Have on hand sufficient pumping equipment, machinery, and tankage in good working condition for ordinary emergencies, including power outage, and competent workers for operation of pumping equipment.

.6 Collect, transport and dispose of waters at off-site licensed disposal facility using a vac truck as identified by Contractor and approved by Departmental Representative. Water removed from excavations and wastewaters from equipment decontamination shall be transported by a licensed liquid waste hauler operating under a MECP Environmental Compliance Approval (ECA). Water shall be disposed of or treated at a licensed facility operating under an ECA and in compliance with O. Reg. 347.

.7 Dispose of water in manner not injurious to public health or safety, to property, or to any part of Work completed or under construction.

.8 Protect site from puddling or running water.

.9 Prevent surface water runoff from leaving Work areas.

.10 Direct surface waters that have not contacted potentially contaminated materials to existing surface drainage systems.

1.11 VEHICULAR ACCESS AND PARKING

.1 Maintenance and Use:

.1 Prevent contamination of access roads. Immediately scrape up debris or material on access roads which is suspected to be contaminated as determined by Departmental Representative; transport and place into designated area approved by Departmental Representative. Clean access roads at least once per shift.

.2 Departmental Representative may collect soil samples for chemical analyses from travelling surfaces of constructed and existing access routes prior to, during, and upon completion of Work. Excavate and dispose of clean soil contaminated by Contractor's activities at no additional cost to Departmental Representative.

1.12 FINAL DECONTAMINATION

.1 Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from site. Refer to section 01 35 43.

.2 Perform decontamination as specified to satisfaction of Departmental Representative will direct Contractor to perform additional decontamination if required.

1.13 REMOVAL AND DISPOSAL

.1 Remove surplus materials and temporary facilities from site.

.2 Dispose of non-contaminated waste materials, litter, debris, and rubbish off site.

.3 Do not burn or bury rubbish and waste materials on site.

.4 Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in ditches.

.5 Do not discharge wastes into streams or waterways.

.6 Dispose of excavated soil and waste water in accordance with Subsections 1.9 and 1.11 at MECP-licensed disposal facilities as approved by Departmental Representative.

.7 Separate and dispose of accumulated waste materials off-site in accordance with R.R.O. 1990, Reg. 347 General Waste Management, to MECP approved disposal facilities or approved transfer stations, including, but not limited to, the following:

.1 Debris including excess construction material.

.2 Non-contaminated litter and rubbish.

.3 Disposable PPE worn during final cleaning.

.4 Non-hazardous and hazardous waste disposal in accordance with Section 01 74 20.

.5 Materials from decontamination pads.

.8 Dispose of materials in accordance with Section 01 74 20 or as directed by Departmental Representative.

.9 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

1.14 RECORD KEEPING

.1 Maintain adequate records to support information provided to Departmental Representative regarding exception reports, annual reports, and biennial reports.

.2 Maintain waste shipment records for minimum of 3 years from date of shipment or longer period required by applicable law or regulation.

.3 Maintain bills of ladings for minimum of 375 days from date of shipment or longer period required by applicable law or regulation.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END

PART 1 - GENERAL

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit 2 copies of WHMIS SDS.

.3 Ten days before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.

.4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.5 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.6 Include in Environmental Protection Plan:
.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
.3 Name and qualifications of persons responsible for training site personnel.
.4 Descriptions of environmental protection personnel training program.
.5 Erosion and sediment control plan (ESCP) identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal best practices, guidelines, laws and regulations.
.6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess materials including methods to control runoff and to contain materials on site.

.7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
.1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized Work areas.
.9 Spills Management and Emergency Response Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
.12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
.13 Waste Water Management Plan identifying methods and procedures for collection, containment and off-site disposal of waste waters which are directly derived from construction activities including but not limited to excavation dewatering, equipment decontamination, well development, clean-up water, and line flushing.
.14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.7 Complete and submit Mitigation Measures and Report Form, Appendix B, in accordance with Subsection 1.15.1 and Section 01 78 00.

1.3 FIRES

.1 Fires and burning of rubbish on site is not permitted.

1.4 DRAINAGE

.1 Develop and submit Erosion and Sediment Control Plan (ESCP) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal best practices, guidelines, laws and regulations.

.2 Provide temporary drainage and pumping required to keep excavations and site free from standing water.

.3 Comply with Section 01 35 13.43 for water pumped from excavations.

.4 Do not allow water containing suspended materials to enter into waterways, sewers or drainage systems.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

.6 Do not direct water flow in a manner which would cause erosion to existing areas.

1.5 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties as indicated.

.2 Protect trees and shrubs adjacent to construction Work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 1.2 m minimum.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

.5 Protect vegetation that does not have to be removed by fencing/delineating Work areas and or storage areas.

.6 Operate construction machinery in a manner that minimizes damage to vegetation.

.7 Stabilize, reseed and/or landscape temporarily disturbed erosion-prone areas as soon as possible following disturbance.

.8 Restrict tree removal to areas designated by Departmental Representative. Obtain permits before trees removal in accordance with the requirements of the authorities having jurisdiction.

1.6 WORK ADJACENT TO WATERWAYS

.1 Construction equipment to be operated on land only.

.2 Materials and equipment shall be operated and stored in a manner that prevents deleterious substances (e.g. petroleum products, silt, etc.) as defined by the Fisheries Act from entering waterways.

.3 Use of waterway beds for borrow material is not permitted.

.4 Waterways to be kept free of excavated fill, waste material and debris.

.5 Design and construct sediment control structures to minimize erosion to waterways.

1.7 EROSION AND SEDIMENT CONTROL

.1 Provide Erosion and Sediment Control Plan (ESCP) that identifies type and location of sediment controls to be provided. Plan must include monitoring and reporting requirements to assure that control measures are in compliance with Federal, Provincial, and Municipal best practices, guidelines, laws and regulations.

.2 Erosion and sediment control measures shall meet the industry standards and best practices as outlined in the OPSS/OPSDs and the "Erosion & Sediment Control Guideline for Urban Construction", Dec. 2006 by the Greater Golden Horseshoe Area Conservation Authorities

.2 Plan and execute construction by methods to control surface drainage from cuts and fills, from stockpiles, staging areas, and other Work areas. Prevent sedimentation.

.3 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and water courses, and repair damage caused by sedimentation as directed by Departmental Representative.

.4 Provide and maintain temporary measures which may include, silt fences, hay or straw bales, ditches, geotextiles, berms and other construction required to prevent migration of silt, mud, sediment, and other debris off site or to other areas of site where damage might result, or that might otherwise be required by Laws and Regulations. Make sediment control measures available during construction.

.5 Plan construction procedures to avoid damage to Work or equipment encroachment onto drainage ditch banks. In event of damage, promptly take action to mitigate effects. Restore affected bank to existing condition.

.6 Installation:

.1 Check sediment control measures weekly and after each rainfall; during prolonged rainfall check daily.

.2 Whenever sedimentation is caused by stripping vegetation, re-grading, or other development, remove it from adjoining surfaces, drainage systems, and watercourses, and repair damage as quickly as possible.

.3 Prior to or during construction, Departmental Representative may require installation or construction of improvements to prevent or correct temporary conditions on site. Improvements may include berms, mulching, sediment traps, grading and other measures appropriate to specific condition. Temporary improvements must remain in place and in operation as necessary or until otherwise directed by Departmental Representative.

.4 Only as directed by Departmental Representative, remove temporary sediment control devices upon completion of Work.

.7 If soil and debris from site accumulate in low areas, roadways, gutters, ditches, or other areas where in Departmental Representative's determination it is undesirable, remove accumulation and restore area to original condition.

1.8 POLLUTION CONTROL

.1 Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by construction operations.

.2 Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on site.

.3 Promptly report spills and releases potentially causing damage to environment to:
.1 Authority having jurisdiction or interest in spill or release including conservation authority, water supply authorities, drainage authority, road authority, and fire department.
.2 Owner of pollutant, if known.
.3 Person having control over pollutant, if known.
.4 Departmental Representative.
.5 Ontario Ministry of Environment Spills Action Centre (1-800-268-6060).

.4 Contact manufacturer of pollutant if known and ascertain hazards involved, precautions required, and measures used in cleanup or mitigating action.

.5 Take immediate action using available resources to contain and mitigate effects on environment and persons from spill or release.

.6 Provide spill response materials including, containers, adsorbent, shovels, and personal protective equipment. Make spill response materials available at all times in which hazardous materials or wastes are being handled or transported. Spill response materials: compatible with type of material being handled.

.7 Maintain temporary pollution control features installed under this contract.

.8 Vehicles and equipment must be maintained in good working condition, equipped with emission controls as applicable to local authorities' emission requirements.

.9 Implement dust abatement measures as required to control dust.

.10 Control emissions from equipment and plant to local authorities' emission requirements.

.11 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.12 Ensure hazardous substances (including fuel) are stored, handled and applied in a manner to prevent release to the environment and in a legal manner in accordance with hazardous waste regulations.

.13 Vehicles shall be shut off when not in use. No vehicle idling on-site.

.14 Store hazardous or toxic substances in a designated area.

.15 Comply with requirements of WHMIS regarding use, handling, storage and disposal of hazardous materials; and regarding labelling and provision of MSDS acceptable to Labour Canada.

.16 Catch basins/storm sewers to be kept free of excavated material, debris and waste.

1.9 SPILLS OR RELEASE OF DELETERIOUS SUSBSTANCES

.1 A Spills Management and Emergency Response Plan will be developed as part of the Environmental Protection Plan and implemented. All workers should be fully aware of the spill prevention and response procedures including notification of Departmental Representative and Ministry of Environment, Conservation and Parks (MECP) Spills Action Centre.

.2 Immediately contain, limit spread and clean up in accordance with provincial regulatory requirements.

.3 The MECP's Spills Action Centre by law must be notified immediately at 1-800-268-6060.

.4 The Departmental Representative shall be immediately informed of all spills that occur on site.

.5 Further information on dangerous goods emergency clean up and precautions including a list of companies performing this Work can be obtained from CANUTEC, the Canadian Transport Emergency Centre operated by Transport Canada, 24-hour number at 1-888-226-8832.

.6 Spill kits will be kept on-site during all project phases.

.7 Contractor shall take due care to ensure no deleterious materials including sediment-laden runoff leave the worksite, or enter any: surface water, storm water, or sanitary sewers at or near the worksite.

.8 Equipment fueling or lubricating shall occur in an area designated by the Departmental Representative with proper controls to prevent the release of deleterious substances, and shall be conducted away from any surface water, storm drains/sewers or collection points.

.9 In accordance with the Fisheries Act, approval must be obtained from DFO for use of any paints, corrosion protective coatings, wood preservatives or any other hazardous material that will be applied to surfaces that will have contact with the marine environment.

.10 Any equipment remaining on site overnight shall have appropriately placed drip pans.

.11 Protect the roadways from tracking of mud, soil, and debris throughout the Work.

.12 Prevent discharges containing asphalt, grout, concrete or other waste materials from reaching storm drains or the marine environment. This includes, but is not limited to:

.1 Minimizing the washing of sand or gravel from new asphalt, debris from drilling or cutting or other materials into storm drains and the marine environment by sweeping.

.2 Application of fog seals, tack coats or other coatings, if required, during periods when rainfall is unlikely to occur during application.

.3 Cleaning equipment off site.
.4 Protection of drainage structures with filter fences if required.

1.10 VEHICULAR ACCESS AND PARKING

.1 Vehicles/equipment shall be in good working order and not be leaking any fuel or fluids.

.2 Restrict access of vehicles from creek banks to protect slope stability.

.3 During construction, establish designated fueling area(s), as approved by Departmental Representative.

.4 Refueling of vehicles and equipment shall not be conducted near watercourses.

1.11 DUST AND PARTICULATE CONTROL

.1 Execute Work by methods to minimize raising dust from construction operations.

.2 Implement and maintain dust and particulate control measures as determined necessary by Departmental Representative during construction and in accordance with Federal, Provincial and Municipal regulations.

.3 Provide positive means to prevent airborne dust from dispersing into atmosphere. Use potable water for dust and particulate control.

.4 Use chemical means for water misting system for dust and particulate control only with Departmental Representative's prior written approval.

.5 As minimum, use appropriate covers on trucks hauling fine or dusty material. Use watertight vehicles to haul wet materials.

.6 Prevent dust from spreading to adjacent properties and waterways.

.7 Departmental Representative will stop Work at any time when Contractor's control of dusts and particulates is inadequate for wind conditions present at site, or when air quality monitoring indicates that release of fugitive dusts and particulates into atmosphere equals or exceeds specified levels.

.8 If Contractor's dust and particulate control is not sufficient for controlling dusts and particulates into atmosphere, stop Work. Contractor must discuss procedures that Contractor proposes to resolve problem. Make necessary changes to operations prior to resuming excavation, handling, processing, or other Work that may cause release of dusts or particulates.

.9 Stockpiles of imported clean backfill material will be protected from erosion and covered to prevent blowing dust.

1.12 NOISE CONTROL

.1 All construction equipment shall be operated with exhaust systems in good repair to minimize noise.

.2 Construction activities that could create excessive noise shall be restricted to daylight hours and adhere to municipal noise by-laws.

.3 If Work is to be undertaken outside the specified period in the local noise by-law, approval for an exemption to the by-law shall be obtained by the Contractor from the municipality.

.4 Ensure that noise control devices (i.e., mufflers, silencers) on construction equipment are properly maintained.

.5 Public complaints will be monitored and responded to in a timely manner. All complaints will be recorded and Contractor shall respond to on an individual basis.

1.13 HISTORICAL/ARCHAEOLOGICAL CONTROL

.1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.

.2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

.3 If archaeological deposits are discovered during the project Work shall stop immediately and the Departmental Representative shall be notified immediately.

.4 Archaeologically significant material, if found on the property, remains the property of the Crown and shall not be removed from the site.

.5 Management of the archaeological materials will be coordinated through the Departmental Representative.

1.14 SPECIES AT RISK

.1 Should a species at risk or its critical habitat be encountered, measures are to be implemented to avoid destruction, injury or interference with the species, its residence and/or its habitat (e.g., through siting, timing or design changes). If the foregoing cannot be avoided Contractor should cease Work and contact Departmental Representative for advice regarding mitigation measures.

1.15 MIGRATORY BIRDS/WILDLIFE HABITATS

.1 Disturbance and destruction of habitat should be timed outside of breeding season of April 1st to August 31st.

.2 Ensure all Works are in compliance with the Migratory Birds Convention Act.

.3 Restrict vehicle movements to construction areas and access roads and avoid harassment of animals.

.4 Conduct Work in such a way as to minimize noise disturbances to birds and wildlife.

.5 If Work is to occur during typical breeding and nesting periods for birds (April 1st to August 31st), a pre-commencement survey of the site by a biologist to confirm that no nests are present with the project footprint is required.

1.16 FISH/FISH HABITAT

.1 All materials and equipment used will be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, silt) as defined by the Fisheries Act from entering the surface water.

1.17 DISPOSAL OF WASTES

.1 Comply with Section 01 74 20.

1.18 MITIGATION MEASURES

.1 Contractor: comply with and implement mitigation measures set out in Table 1 of Mitigation Measures and Report Form, Appendix B.

1.19 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.

.1 Take action only after receipt of written approval by Departmental Representative.

.3 Departmental Representative will issue stop order of Work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00. Leave Work area clean at end of each day.

.2 Remove rubbish from Site in accordance with Authorities having jurisdiction.

.3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This section describes Construction Indoor Air Quality (IAQ) requirements

.2 The Owner has established that this project is to generate the least amount of airborne contaminants possible. Where contaminants are unavoidable, implement control measures to protect the health and safety of construction personnel and to prevent residual building contaminants from affecting the indoor air quality over the lifetime of the building

.3 The Contractor is responsible for the identification and management of construction related airborne contaminants in compliance with all municipal, provincial and federal Acts and regulations.

.4 The Contractor is responsible for the management of Indoor Air Quality for all building areas.

1.2 REFERENCED STANDARDS

.1 ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers.
.1 ASHRAE 52.2-2017, Method Of Testing General Ventilation Air-Cleaning Devices For Removal Efficiency By Particle Size.

.2 CEN - Comité Européen de Normalisation.
.1 EN 779-2012, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance.

.3 SMACNA - Sheet Metal and Air Conditioning National Contractors Association.
.1 SMACNA 008-2007, IAQ Guideline for Occupied Buildings Under Construction.

1.3 REQUIREMENTS

.1 General Requirements
.1 IAQ Manager: The Contractor shall designate an on-site party responsible for instructing workers, monitoring, documenting, and photographing the IAQ Management Plan for the project.
.2 Instruction: The Contractor shall provide on-site instruction of appropriate IAQ management measures.
Meetings: Contractor shall discuss IAQ Management at meetings which include Subcontractors affected by the IAQ Management Plan. At a minimum, IAQ management shall be discussed at the following meetings: Pre-construction meeting, Regular job-site meetings, as needed.

.2 Non-Smoking Building
.1 For the duration of construction activities, Contractor shall provide clear signage indicating the site’s non-smoking policy. Signage shall read as follows: No smoking allowed within the building, or within 7.5m of entrances, windows, or fresh air intakes.

.4 Develop and implement an Indoor Air Quality Management Plan for the construction and pre-occupancy phases of the building. The Contractor and all Subcontractors are required to comply with the Indoor Air Quality Management Plan. Distribute the Plan to all relevant Subcontractors, and posted in an accessible location onsite.

.5 Address all of the following in the Plan:

.1 Protect absorptive materials stored on-site and installed from moisture damage.

.2 Do not operate permanently installed air-handling equipment during construction unless filtration media with a minimum efficiency reporting value (MERV) of 8, as determined by ASHRAE 52.2, with errata (or equivalent filtration media class of F5 or higher, as defined by CEN Standard EN 779–2002, are installed at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media.

.3 Immediately before occupancy, replace all filtration media with the final design filtration media, installed in accordance with the manufacturer’s recommendations.

.4 Prohibit the use of tobacco products inside the building and within 25 feet (7.5 meters) of the building entrance during construction.

.5 During construction, meet or exceed all applicable recommended control measures of SMACNA 008, Chapter 3. The SMACNA guideline can be accessed at www.smacna.org. The following SMACNA guidelines shall be followed:

.1 HVAC Protection:

.1 Keep contaminants out of the HVAC system. Do not run permanently installed equipment if possible, or maintain proper filtration if it is used.

.2 If conditioning is required during construction, use supplementary HVAC units instead of permanently installed equipment if possible.

.3 If permanently installed HVAC system must be used during construction, install filtration to protect the return (negative pressure) side of the system. Replace these filters regularly during construction.

.4 Seal all ductwork, registers, diffusers, and returns when stored on site or not in service. The seal shall be secure around the border of the supply and return openings. Seal unfinished runs of ductwork at the end of each day.

.5 Replace all filtration media before occupancy.

Do not store materials in mechanical rooms, to reduce potential debris and contamination to mechanical systems.

.2 Source Control:

.1 Keep sources of contaminants out of the building and have a plan to eliminate any that are introduced.

.2 Use low-toxicity and low-VOC materials to the greatest extent possible.

.3 Develop protocols for the use of any high-toxicity materials. Isolate areas where high-toxicity materials are being installed and use temporary ventilation for that area.

.4 Prevent exhaust fumes (from idling vehicles, equipment, and fossil-fueled tools) from entering the building. Prioritize the use of electric equipment such as forklifts and heaters.

.5 Enforce the no-smoking job site policy.

.6 Store materials in dry conditions indoors, under cover, and off the ground or floor. Protect stored materials from moisture because absorbent materials exposed to moisture during construction can mould and degenerate long after installation.

.7 If materials are improperly exposed to moisture, replace the material and consider testing air quality before occupancy to make sure no mould contamination has occurred.

.3 Pathway Interruption:

.1 Prevent circulation of contaminated air when cutting concrete or wood, sanding drywall, installing VOC-emitting materials, or performing other activities that affect IAQ in other Work spaces.

.2 When possible, locate particulate-producing activities, such as a cutting station, outdoors.

.3 Isolate areas of Work to prevent contamination of other spaces, whether they are finished or not. Seal doorways, windows, or tent off areas as needed using temporary barriers, such as plastic separations. Provide walk-off mats at entryways, in elevator lobbies and in stairwells to reduce introduced dirt and pollutants.

.4 Depressurize the Work area to allow a differential between construction areas and clean areas. Exhaust to the outdoors using 100% outdoor air, if possible.

.5 Use dust guards and collectors on saws and other tools.

.6 Bag sawdust at the end of each day.

.4 Housekeeping:

.1 Maintain good job site housekeeping on a daily basis. Use vacuum cleaners with high-efficiency particulate filters and use sweeping compounds or wetting agents for dust control when sweeping.

.2 Keep materials organized to improve job site safety as well as indoor air quality.

.3 Any interior water accumulation or spills must be cleaned up immediately.

.5 Scheduling:

.1 For major renovations, coordinate construction activities to minimize or eliminate disruption of operations in occupied areas.

.2 Keep trades that affect IAQ physically isolated on site and separated from each other by the construction schedule. For example, schedule drywall finishing and carpet installation for different days or different sections of the building. Consider after-hours or weekend Work if practical.

.3 Install absorptive-finish materials after wet-applied materials have fully cured whenever possible. For example, install carpet and ceiling tile after paints and stains are completely dry.

.4 Remove all temporary filtration media and replace them with new filters before occupancy.

END

PART 1 - GENERAL

1.1 CONSTRUCTION AND DEMOLITION WASTE

.1 Carefully deconstruct and source separate Materials/equipment and divert, from demolition and construction waste destined for landfill to maximum extent possible. Target for this project is 50% diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell Material for reuse except where indicated otherwise. On site sales are not permitted.

.2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
- .1 Provide facilities for collection, handling and storage of source separated wastes.
- .2 Source separate the following waste:
  - .1 Corrugated cardboard.
  - .2 Wood, not including painted or treated wood or laminated wood.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Submit a Waste Management Plan 5 days prior to the commencement of Work activities, including complete list of wastes, including waste registration numbers as required by provincial regulations, for Materials that will be generated by Work activities.
- .1 Indicate Materials and quantities of Material that will be recycled and diverted from landfill.
- .2 Indicate how material being removed from the site will be reused and recycled.

.3 Submit proof that all waste is being disposed of at a licensed landfill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the sites.

1.3 WASTE PROCESSING SITES

.1 Province of: Ontario.
- .1 Ministry of the Environment, Conservation and Parks (MECP), Public Information Centre, 2nd Floor - MacDonald Block, Suite M2-22 - 900 Bay Street, Toronto, ON, M7A 1N3.
- .2 General Inquiry: 416-325-4000 or 1-800-565-4923 TTY (for persons who are deaf, deafened or hard of hearing).
- .3 Telephone: 416-326-9236 or 1-800-515-2759.
- .4 Fax: 416-323-4682.

.2 Recycling Council of Ontario: 55 University Ave., #1500, Toronto, ON, M5J 2H7.
- .1 Telephone: 416-657-2797.

.2 Fax: 416-960-8053.
.3 Email: rco@rco.on.ca.
.4 Internet: http://www.rco.on.ca/.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Unless specified otherwise, Materials for removal become Contractor's property.

.2 Protect, stockpile, store and catalogue salvaged items for reuse/recycling. Stockpiling of excavated soil is not permitted.

.3 Separate non-salvageable Materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.4 Prevent contamination of materials to be salvaged and recycled and handle Materials in accordance with requirements for acceptance by designated facilities.
.1 On-site source separation is recommended.
.2 Remove co-mingled Materials to off-site processing facility for separation.
.3 Provide waybills for separated Materials.

.5 Prevent the contamination of the ground surface, ground water and/or surface water from deleterious substances, contaminants and/or hazardous Materials contained within, or forming part of the Materials for recycling, reuse, and/or salvage.

.6 Direct load (i.e., no stockpiling) of waste Materials whenever possible.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Do not bury rubbish and waste Materials on site.

.2 All waste Materials shall be disposed of in a legal manner at a site approved by Local Authorities and the Departmental Representative.

.3 Provide acceptable containers for collection and disposal of waste Materials, debris and rubbish.

.4 Do not allow deleterious substances to enter or contaminate ground surface, ground water or waterways.

.5 Keep records of construction waste including:
.1 Number and size of bins.
.2 Waste type of each bin.
.3 Total tonnage generated.
.4 Tonnage reused or recycled.
.5 Reused or recycled waste destination.

.6 Remove from site and dispose of all packaging Materials at appropriate recycling facilities.

.7 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging Material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.8 All waste materials including containers and waste fluids associated with vehicle maintenance shall be disposed of in a legal manner at a site approved by Local Authorities.

.9 Divert unused metal Materials from landfill to metal recycling facility as approved by Departmental Representative.

.10 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 – EXECUTION

3.1 APPLICATION

.1 Handle waste Materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

.1 Remove tools and waste Materials on completion of Work, and leave Work area in clean and orderly condition.

.2 Clean-up Work area as Work progresses.

.3 Source separate Materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
- .1 Mark containers or stockpile areas.
- .2 Provide instruction on disposal practices.

.2 Divert unused paint/coating Materials from landfill to official hazardous material collections site approved by Departmental Representative.

.3 Divert unused metal and wiring Materials from landfill to metal recycling facility approved by Departmental Representative.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Definitions:
- .1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.2 Reference Standards:
- .1 Canadian Environmental Protection Act, 1999 (CEPA 1999).
  - .1 Export and Import of Hazardous Waste Regulations.
  - .2 Ontario Environmental Protection Act, R.R.O 1990.
  - .3 General – Waste Management, O. Reg. 347/90, as amended.
- .2 Occupational Health and Safety Act
  - .1 Designated Substances, O. Reg. 490/09, as amended
  - .2 Designated Substances - Asbestos on Construction Projects and In Building and Repair Operations, O. Reg, 278/05, as amended
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 WHMIS Safety Data Sheets (SDS).
  - .2 National Fire Code of Canada 2015
  - .3 Transportation of Dangerous Goods Act, as amended.
  - .4 Transportation of Dangerous Goods Regulations, as amended.

1.2 EXISTING CONDITIONS

.1 Refer to the following documents for details on designated substances and hazardous materials:
- .1 Project Specific Designated Substance Survey, Search and Rescue Station, Port Weller, Ontario. Prepared by DST Consulting Engineers Inc. February 21, 2018.
- .2 Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station Port Weller ON. Prepared by Stantec Consulting Ltd. and dated June 19, 2018.
- .3 Refer to Soil and Groundwater Assessment in Support of Proposed Construction Project, Port Weller Search and Rescue Station, Final Report, Dillon Consulting Limited, February 2019.

.2 Work site may involve contact with the following:
- .1 Asbestos.
- .2 Lead.
- .3 Benzene.

.4 Mercury.
.5 Silica.
.6 Halocarbons.
.7 Other hazardous materials and chemicals.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS SDS to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
.3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

.2 Submittals:
.1 Construction Waste Management:
.1 Submit project Waste Management Plan and/or Waste Reduction Workplan, as required, highlighting recycling and salvage requirements.
.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that construction wastes were recycled or salvaged
.3 Low-Emitting Materials: submit listing of adhesives, sealants and paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Separate waste materials for reuse and recycling.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.4 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
.1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.

.5 Storage and Handling Requirements:

.1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for Work purposes requires the written approval of the Departmental Representative.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.

.7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 Observe smoking regulations, smoking is prohibited in areas where hazardous Materials are stored, used, or handled.

.10 Storage requirements for quantities of hazardous Materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous Materials and wastes in closed and sealed containers.

.2 Label containers of hazardous Materials and wastes in accordance with WHMIS.

.3 Store hazardous Materials and wastes in containers compatible with that Material or waste.

.4 Segregate incompatible Materials and wastes.

.5 Ensure that different hazardous Materials or hazardous wastes are stored in separate containers.

.6 Store hazardous Materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous Materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous Materials and wastes, including product name, quantity, and date when storage began.

.11 When hazardous waste is generated on site:

.12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
.13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Description:
.1 Bring on site only quantities hazardous Material required to perform Work.
.2 Maintain SDS in proximity to where Materials are being used. Communicate this location to personnel who may have contact with hazardous Materials.

PART 3 - EXECUTION

3.1 CLEANING

.1 Progress Cleaning:
.1 Leave Work Area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus Materials, rubbish, tools and equipment.

.3 Waste Management: separate waste Materials for reuse and recycling.
.1 Dispose of hazardous waste Materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
.5 Disposal of hazardous Materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
.6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
.1 Hazardous wastes recycled in manner constituting disposal.
.2 Hazardous waste burned for energy recovery.
.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing the following Work:

.1 Removal of non-friable asbestos-containing materials, if the material is removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.

.2 Removal of non-friable asbestos-containing materials, if the material is removed by breaking, cutting, drilling, abrading, grinding, or vibrating, if the material is wetted to control the spread of dust and fibres, and the Work is only done by non-powered hand-held tools.

1.2 SECTION INCLUDES

.1 Requirements and procedures for asbestos abatement of non-friable asbestos-containing materials.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.205-03, Sealer for Application of Asbestos-Fibre Releasing Materials.

.2 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.4 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Ontario Environmental Protection Act, R.R.O 1990,

.1 General – Waste Management, O. Reg. 347/90, as amended.

.6 Underwriters' Laboratories of Canada (ULC).

.7 National Joint Council (NJC).

.1 Part XI – Hazardous Substances.

.8 PSPC Asbestos Management Directive

.9 Canada Labour Code Part II, section 124 and 125.

.1 Canada Occupational Health and Safety Regulations

.10 Ontario Ministry of Labour, Training, and Skills Development (MoLTSD).

.1 Occupational Health and Safety Act, R.S.O 1990, c. O1 (OSHA)

.1 O. Reg. 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations, as amended

.2 Ontario Occupational Health and Safety Act, R.S.O. 1990, Regulation 490/09 "Designated Substances", as amended

1.4 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Amended Water: water with nonionic surfactant wetting agent added to reduce water tension to allow thorough wetting of fibres.

.3 Asbestos-Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.

.4 Asbestos Work Area: area where Work takes place which will, or may, disturb ACMs.

.5 Authorized Visitors: Departmental Representative or designated representatives, and representatives of regulatory agencies.

.6 Competent worker person: in relation to specific Work, means a worker who:
.1 Is qualified because of knowledge, training and experience to perform the work.
.2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the Work.
.3 Has knowledge of all potential or actual danger to health or safety in the Work.

.7 Friable material: means material that:
.1 When dry, can be crumbled, pulverized or powdered by hand pressure, or
.2 is crumbled, pulverized or powdered.

.8 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.9 Occupied Area: any area of the building or Work site that is outside Asbestos Work Area.

.10 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

.11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for Work.

1.5 SUBMITTALS

.1 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.

.2 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.3 Submit proof of Contractor's Asbestos Liability Insurance.

.4 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.

.5 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and Work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.6 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (Quantitative Fit Testing) with respirator that is personally issued.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial, and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications, more stringent requirement applies. Comply with regulations in effect at time Work is performed.

.2 Health and Safety:
.1 Safety Requirements: worker protection.
.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
.1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored

in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.

.2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.3 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.4 Facilities for washing hands and face shall be provided within or close to the Asbestos Work Area.

.5 Ensure workers wash hands and face when leaving Asbestos Work Area.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers waste in accordance with Waste Management Plan, as applicable.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal banding, flatten and place in designated area for recycling.

.8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.15 mm thick (6 mil) bags or leak proof drums. Label containers with appropriate warning labels. All waste bags or drums containing asbestos-containing materials shall be kept inside the containment or in the staging area until pick-up for transportation to licensed landfill.

.9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Non-friable black tar, applied to wooden frame within Basement water Treatment room of the Office House contains 1.79% Chrysotile asbestos. Approximately 5 linear metres of this material was observed.

.2 Non-friable mastic, applied to the plywood subfloor in the Galley House living room contains 1% Chrysotile Asbestos. The extent of this material could not be ascertained as it was concealed beneath plywood sheeting. As such, this material should be assumed present throughout all of the ground floor rooms/areas of the Galley House, unless additional destructive investigation confirms otherwise.

.3 Non-friable caulking, applied to the exterior windows frames throughout the exterior contains 2% Chrysotile Asbestos. Approximately 175 linear metres of caulking is present.

.4 Non-friable caulking, applied to basement windows throughout the exterior of the buildings contains 5% Chrysotile Asbestos. Approximately 5 linear metres of this material was observed at the time of site visit.

.5 Refer to the following for details on asbestos-containing materials:

.1 Project Specific Designated Substance Survey, Search and Rescue Station, Port Weller, Ontario. Prepared by DST Consulting Engineers Inc. February 21, 2018.

.2 Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station Port Weller ON. Prepared by Stantec Consulting Ltd. and dated June 19, 2018.

.3 Section 02 81 01.01 Schedule A Hazardous Materials Table

.6 Notify Departmental Representative of asbestos-containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

1.9 SCHEDULING

.1 Hours of Work: perform Work involving asbestos abatement located at the Building during hours specified by Departmental Representative. The Work schedule must be approved in writing by the Departmental Representative in advance of Work. Contractor shall be available to Work continuously from beginning to end of project.

1.10 INSTRUCTIONS

.1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and Work practices, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, following minimum requirements:
- .1 Fitting of equipment.
- .2 Inspection and maintenance of equipment.
- .3 Disinfecting of equipment.
- .4 Limitations of equipment.

.3 Instruction and training must be provided by a competent, qualified person.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Drop Sheets:
- .1 Polyethylene: 0.15 mm thick.
- .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.

.3 Waste Containers: contain waste in two separate containers.
- .1 Inner container: 0.15 mm thick sealable polyethylene waste bag.
- .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
- .3 Labelling requirements: affix pre-printed cautionary asbestos warning in both official languages that is visible when ready for removal to disposal site.

.4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.5 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

PART 3 - EXECUTION

3.1 PROCEDURES

.1 Before beginning Work, isolate Asbestos Work Area using, minimum, preprinted cautionary asbestos warning signs in both official languages that are visible at access routes to Asbestos Work Area.

.1 Remove visible dust from surfaces in the work area where dust is likely to be disturbed during course of work.

.2 Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.

.3 Do not use compressed air to clean up or remove dust from any surface.

.2 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.

.1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in Asbestos Work Area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.

.3 Wet materials containing asbestos to be cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates hazard or causes damage.

.1 Use garden reservoir type low - velocity fine - mist sprayer.

.2 Perform Work to reduce dust creation to lowest levels practicable.

.3 Work will be subject to visual inspection and air monitoring.

.4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas, at no additional cost to the Departmental Representative

.4 Frequently and at regular intervals during Work and immediately on completion of Work:

.1 Dust and waste to be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a waste container, and

.2 Drop sheets to be wetted and placed in a waste container as soon as practicable.

.5 Cleanup:

.1 Place dust and asbestos containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and then place in plastic bags.

.2 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum and place in second clean waste bag immediately prior to removal from Asbestos Work Area.

.3 Seal waste bags and remove from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal Authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that the appropriate guidelines and regulations for asbestos disposal are followed.

.4 Perform final thorough clean-up of Work areas and adjacent areas affected by Work using HEPA vacuum.

3.2 INSPECTION

.1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviation(s) from these requirements that have not been approved in writing by Departmental Representative may result in Work stoppage, at no cost to Departmental Representative.

.2 Departmental Representative may inspect Work at any time during the project for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Departmental Representative may order Work shutdown.

.4 No additional costs will be allowed by the Contractor for additional labour or materials required to provide specified performance level.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing the following Work:
  .1 Removing non-friable asbestos containing Materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating if:
    .1 The Material is not wetted to control the spread of dust or fibres, and
    .2 The Work is done only by means of non-powered hand-held tools.
  .2 Removing non-friable asbestos containing Materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating at if the Work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.

1.2 SECTION INCLUDES

.1 Requirements and procedures for asbestos abatement of asbestos-containing Materials of the type described within.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-1.205-03, Sealer for Application of Asbestos-Fibre Releasing Materials.

.2 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 WHMIS Safety Data Sheets (SDS).

.4 Transport Canada (TC).
  .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Ontario Environmental Protection Act, R.R.O 1990.
  .1 General – Waste Management, O. Reg. 347/90, as amended.

.6 Underwriters' Laboratories of Canada (ULC).

.7 National Joint Council (NJC).
  .1 Part XI – Hazardous Substances.

.8 PSPC Asbestos Management Directive.

.9 Canada Labour Code Part II, section 124 and 125.
  .1 Canada Occupational Health and Safety Regulations

.10 Ontario Ministry of Labour, Training, and Skills Development (MoLTSD).
.1 Occupational Health and Safety Act, R.S.O 1990, c. O1 (OSHA).
.1 O. Reg. 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations, as amended.
.2 Ontario Occupational Health and Safety Act, R.S.O. 1990, Regulation 490/09 "Designated Substances", as amended.

1.4 DEFINITIONS

.1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.2 Asbestos Containing Materials (ACMs): Materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen Materials and settled dust.

.3 Asbestos Work Area: area where Work takes place which will, or may disturb ACMs.

.4 Authorized Visitors: Departmental Representative or designated representatives, and representatives of regulatory agencies.

.5 Competent worker person: in relation to specific work, means a worker who:
.1 Is qualified because of knowledge, training and experience to perform the Work.
.2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the Work.
.3 Has knowledge of all potential or actual danger to health or safety in the Work.

.6 Friable Materials: Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such Material that is crumbled, pulverized or powdered.

.7 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.

.8 Non-Friable Material: Material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.9 Occupied Area: any area of building or Work site that is outside Asbestos Work Area.

.10 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

.11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of Work.

1.5 SUBMITTALS

.1 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.

.2 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.3 Submit proof of Contractor's Asbestos Liability Insurance.

.4 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.

.5 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of Work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.6 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.7 Submit Worker's Safety and Insurance Board status and transcription of insurance.

.8 Submit documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for chemicals or Materials including:
.1 Encapsulants.
.2 Amended water.
.3 Slow drying sealer.

.10 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing (Quantitative Fit Testing). Workers must be fit tested with respirator that is personally issued.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time Work is performed.

.2 Health and Safety:
.1 Safety Requirements: worker and visitor protection.
.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
.1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.
.2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn.
.3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
.2 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the Work area, and removed from the Work area frequently and at regular intervals.

.3 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing shall be provided within or close to the Asbestos Work Area.

.4 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.5 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to Work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse and recycling.

.2 Remove from site and dispose of packaging Materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging Material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.

.5 Place Materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous Materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal banding, flatten and place in designated area for recycling.

.8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.15 mm thick (6 mil) bags or leak proof drums. Label containers with appropriate warning labels.

.9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Non-friable black tar, applied to wooden frame within Basement water Treatment room of the Office House contains 1.79% Chrysotile asbestos. Approximately 5 linear metres of this Material was observed.

.2 Non-friable mastic, applied to the plywood subfloor in the Galley House living room contains 1% Chrysotile Asbestos. The extent of this Material could not be ascertained as it was concealed beneath plywood sheeting. As such, this Material should be assumed present throughout all of the ground floor rooms/areas of the Galley House, unless additional destructive investigation confirms otherwise.

.3 Non-friable caulking, applied to the exterior windows frames throughout the exterior contains 2% Chrysotile Asbestos. Approximately 175 linear metres of caulking is present.

.4 Non-friable caulking, applied to basement windows throughout the exterior of the buildings contains 5% Chrysotile Asbestos. Approximately 5 linear metres of this Material was observed at the time of site visit.

.5 Refer to the following for details on asbestos-containing Materials:
.1 Project Specific Designated Substance Survey, Search and Rescue Station, Port Weller, Ontario. Prepared by DST Consulting Engineers Inc. February 21, 2018.
.2 Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station Port Weller ON. Prepared by Stantec Consulting Ltd. and dated June 19, 2018.
.3 Section 02 81 01.01 Schedule A Hazardous Materials Table

.6 Notify Departmental Representative of asbestos-containing Material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such Material pending instructions from Departmental Representative.

1.9 SCHEDULING

.1 Not later than ten (10) days before beginning Work on this Project notify following in writing:
.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
.2 Regional Office of Labour Canada.
.3 Provincial/Territorial, Department of Labour.
.4 Disposal Authority.

.2 Inform sub-trades of presence of asbestos containing Materials identified in Existing Conditions.

.3 Submit to Departmental Representative copy of notifications prior to start of Work.

1.10 INSTRUCTIONS

.1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and Work practices, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:
.1 Fitting of equipment.
.2 Inspection and maintenance of equipment.
.3 Disinfecting of equipment.
.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Drop and Enclosure Sheets:
.1 Polyethylene: 0.15 mm thick.
.2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing Material.

.3 Waste Containers: contain waste in two separate containers.
.1 Inner container: 0.15 mm thick sealable polyethylene bag
.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste Material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
.3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.

.4 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.5 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
.1 Sealer: flame spread and smoke developed rating less than 50.

.6 Encapsulant: Penetrating type conforming to CAN/CGSB-1.205.

PART 3 - EXECUTION

3.1 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing Materials.

3.2 PROCEDURES

.1 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

.2 Before beginning Work remove visible dust from surfaces in Work area where dust is likely to be disturbed during course of Work.
- .1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.
- .2 Do not use compressed air to clean up or remove dust from any surface.

.3 Prevent spread of dust from Asbestos Work Area using measures appropriate to Work to be done.
- .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in Work areas where dust or contamination cannot otherwise be safely contained.
- .2 When removing asbestos containing Material erect enclosure of polyethylene sheeting around Work area, shut off mechanical ventilation system serving Work area and seal ventilation ducts to and from Work area.

.4 Remove loose Material by HEPA vacuum; thoroughly wet friable Material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.
- .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
- .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.

.5 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.6 Cleanup:
- .1 Frequently during Work and immediately after completion of Work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
- .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.
- .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of Material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, the Departmental Representative will collect air samples on a daily basis in the outside the enclosures.

.2 If air monitoring shows that areas outside Work area enclosures or clean room are contaminated, enclose, maintain, and clean these areas in same manner as that applicable to Asbestos Work Areas:

.1 Stop Work and clean areas outside of Asbestos Work Areas when Phased Contrast Microscopy measurements exceed 0.05 fibres per cubic centimetre (f/cc) and correct procedures.

.2 All required cleaning, re-cleaning, additional air testing and/or inspections will be performed at no extra charge to the Departmental Representative.

.3 The Departmental Representative will collect clearance air samples inside the enclosure following a final visual inspection of the Asbestos Work Area by the Departmental Representative. Samples will be analyzed and compared to applicable regulations.

.1 Final air monitoring results must show fibre levels of less than 0.05 fibres per cubic centimetre (f/cc).

.2 If air monitoring shows that areas inside the Asbestos Work Area enclosures are contaminated; enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area at no additional cost to the Departmental Representative.

.3 Repeat as necessary until fibre levels are less than 0.05 f/cc

.4 No additional costs will be allowed by Contractor for additional labour or Materials required to provide specified performance level.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing the following Work:
  .1 Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos containing Material, if the Work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters.

1.2 SECTION INCLUDES

.1 Requirements and procedures for asbestos abatement of asbestos-containing Materials of the type described within.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-1.205-03, Sealer for Application of Asbestos-Fibre Releasing Materials.

.2 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Safety Data Sheets (SDS).

.4 Transport Canada (TC).
  .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Ontario Environmental Protection Act, R.R.O 1990,
  .1 General – Waste Management, O. Reg. 347/90, as amended.

.6 Underwriters' Laboratories of Canada (ULC).

.7 National Joint Council (NJC).
  .1 Part XI – Hazardous Substances.

.8 PSPC Asbestos Management Directive.

.9 Canada Labour Code Part II, section 124 and 125.
  .1 Canada Occupational Health and Safety Regulations.

.10 Ontario Ministry of Labour, Training, and Skills Development (MoLTSD).
  .1 Occupational Health and Safety Act, R.S.O 1990, c. O1 (OSHA)
    .1 O. Reg. 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations, as amended.
    .2 Ontario Occupational Health and Safety Act, R.S.O. 1990, Regulation 490/09 “Designated Substances”, as amended.

1.4 DEFINITIONS

.1 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.

.2 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.3 Asbestos Containing Materials (ACMs): Materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen Materials and settled dust.

.4 Asbestos Work Areas: area where Work takes place which will, or may disturb ACMs.

.5 Authorized Visitors: Departmental Representatives or designated representatives, and representatives of regulatory agencies.

.6 Competent worker person: in relation to specific Work, means a worker who:
- .1 Is qualified because of knowledge, training and experience to perform the Work.
- .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the Work.
- .3 Has knowledge of all potential or actual danger to health or safety in the Work.

.7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:
- .1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
- .2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.
- .3 Overlap each polyethylene sheet at openings not less than 1.5m on each side.

.8 DOP Test: testing method used to determine integrity of Negative Pressure unit using Dispersed Oil Particulate (DOP) HEPA-filter leak test.

.9 Friable Materials: Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such Material that is crumbled, pulverized or powdered.

.10 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.11 Negative pressure: system that extracts air directly from Work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside Work area to exterior of building.

.1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of Work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.

.13 Non-Friable Materials: Material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.14 Occupied Areas: any area of building or Work site that is outside Asbestos Work Area.

.15 Polyethylene sheeting sealed with tape: polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.

.16 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of Work.

1.5 SUBMITTALS

.1 Before beginning Work:

.1 Obtain from appropriate agency and submit to Departmental Representative necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of Material being dumped, and proper methods of disposal. Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to receive and properly dispose of asbestos waste.

.2 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person on hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of Work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing. Submit proof of attendance in form of certificate.

.3 Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.

.4 Submit layout of proposed enclosures and decontamination facilities to Departmental Representative for review.

.5 Submit documentation including test results for sealer proposed for use.

.6 Submit Provincial/Territorial and/or local requirements for Notice of Project form.
.7 Submit proof of Contractor's Asbestos Liability Insurance.
.8 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.
.9 Submit Workplace Safety and Insurance Board status and transcription of insurance.
.10 Submit documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for chemicals or Materials including but not limited to following:
.1 Encapsulants.
.2 Amended water.
.3 Slow drying sealer.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time Work is performed.

.2 Health and Safety:
.1 Safety Requirements: worker and visitor protection.
.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:
.1 Air purifying full face-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the Work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn. Requirements for each worker:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving Work area then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated Work suits in receptacles for disposal with other asbestos - contaminated Materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in Work area, store Work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from Work area or from Equipment and Access Room.

.3 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's Work, or in clean coveralls before eating, smoking, or drinking. If re-entering Work area, follow procedures outlined in paragraphs above.

.4 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers must not use this system as means to leave or enter Work area.

.2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
.3 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.
.4 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
.5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
.6 Visitor Protection:
.1 Provide protective clothing and approved respirators to Authorized Visitors to Work areas.
.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse and recycling.

.2 Remove from site and dispose of packaging Materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging Material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous Materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal banding, flatten and place in designated area for recycling.

.8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.15 mm thick (6 mil) bags or leak proof drums. Label containers with appropriate warning labels.

.9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Non-friable black tar, applied to wooden frame within Basement water Treatment room of the Office House contains 1.79% Chrysotile asbestos. Approximately 5 linear metres of this Material was observed.

.2 Non-friable mastic, applied to the plywood subfloor in the Galley House living room contains 1% Chrysotile Asbestos. The extent of this Material could not be ascertained as it was concealed beneath plywood sheeting. As such, this Material should be assumed present throughout all of the ground floor rooms/areas of the Galley House, unless additional destructive investigation confirms otherwise.

.3 Non-friable caulking, applied to the exterior windows frames throughout the exterior contains 2% Chrysotile Asbestos. Approximately 175 linear metres of caulking is present.

.4 Non-friable caulking, applied to basement windows throughout the exterior of the buildings contains 5% Chrysotile Asbestos. Approximately 5 linear metres of this material was observed at the time of site visit.

.5 Refer to the following for details on asbestos-containing materials:

.1 Project Specific Designated Substance Survey, Search and Rescue Station, Port Weller, Ontario. Prepared by DST Consulting Engineers Inc. February 21, 2018.

.2 Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station Port Weller ON. Prepared by Stantec Consulting Ltd. and dated June 19, 2018.

.3 Section 02 81 01.01 Schedule A Hazardous Materials Table.

.6 Notify Departmental Representative of asbestos-containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such Material pending instructions from Departmental Representative.

1.9 SCHEDULING

.1 Not later than ten (10) days before beginning Work on this Project notify following in writing:

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Regional Office of Labour Canada.

.3 Provincial/Territorial, Department of Labour.

.4 Disposal Authority.

.2 Inform sub-trades of presence of asbestos containing materials identified in Existing Conditions.

.3 Submit to Departmental Representative copy of notifications prior to start of Work.

1.10 INSTRUCTIONS

.1 Before beginning Work, provide to Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of Work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:
- .1 Proper fitting of equipment.
- .2 Inspection and maintenance of equipment.
- .3 Disinfecting of equipment.
- .4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Supervisory personnel to complete required training.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: minimum 0.15 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

.4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other Material approved by Departmental Representative, mixed with water in concentration to provide adequate penetration and wetting of asbestos containing Material.

.5 Waste Containers: contain waste in two separate containers.
- .1 Inner container: 0.15 mm thick sealable polyethylene bag.
- .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste Material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
- .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site. Label in both official languages.

.6 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.7 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.8 Sealer: flame spread and smoke developed rating less than 50

.7 Encapsulant: Penetrating type conforming to CAN/CGSB-1.205.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Work Areas:

.1 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during Work phase. Conduct smoke tests to ensure that duct ork is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.

.2 Preclean potentially moveable furniture and carpeting within proposed Work areas using HEPA vacuum and remove from Work areas to temporary location.

.3 Preclean fixed casework, plant, and equipment within proposed Work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.4 Clean proposed Work areas using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.

.5 The spread of dust from the Work area to be prevented by:

.1 Using enclosures of polyethylene or other suitable Material that is impervious to asbestos (including, if the enclosure Material is opaque, one or more transparent window areas to allow observation of the entire Work area from outside the enclosure), if the Work area is not enclosed by walls.

.2 Using curtains of polyethylene sheeting or other suitable Material that is impervious to asbestos, fitted on each side of each entrance or exit from the Work area.

.6 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of Work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument. The system to maintain a negative air pressure of 5 Pa (0.02 inches) of water, relative to the area outside the enclosed area. The system to be inspected and maintained by a competent person prior each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it to be replaced before the ventilation system is used.

.7 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.8 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Cover floors first so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting.

.9 Build airlocks at entrances to and exits from Work areas so that Work areas are always closed off by one curtained doorway when workers enter or exit.

.10 At each access to Work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)".

.11 After Work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Departmental Representative. Use localized water spraying during fixture removal to reduce fibre dispersal.

.12 Maintain emergency and fire exits from Work areas, or establish alternative exits satisfactory to Fire Commissioner of Canada and Provincial/Territorial Fire Marshall Authority having jurisdiction.

.13 Where application of water is required for wetting asbestos containing Materials, shut off electrical power, provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.2 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:

.1 Equipment and Access Room: build Equipment and Access Room between Shower Room and Work areas, with two curtained doorways, one to Shower Room and one to Work areas. Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in Work areas. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.

.2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water, as per provincial requirements. Water source will be designated by Departmental Representative. Drains to common sewers will be designated by the Departmental Representative. Provide piping and connect to water sources and drains. Pump waste

water through 5 micrometre filter system acceptable to Departmental Representative before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.

.3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.3 Container and Equipment Decontamination Enclosure System:

.1 Container and Equipment Decontamination Enclosure System consists of Staging Area within Work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and Material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.

.1 Staging Area: designate Staging Area in Work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.

.2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.

.3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.

.4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.

.4 Construction of Decontamination Enclosures:

.1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. Use two layers of FR polyethylene on floors

.2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.5 Separation of Work Areas from Occupied Areas:
.1 Separate parts of building required to remain in use as specified by the Departmental Representative from parts of building used for asbestos abatement by means of airtight barrier system constructed as follows:
.1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9 mm minimum thick plywood. Seal joints between plywood sheets and between plywood and adjacent Materials with surface film forming type sealer, to create airtight barrier.
.2 Cover plywood barrier with polyethylene sealed with tape, as specified for Work areas.

.6 Maintenance of Enclosures:
.1 Maintain enclosures in tidy condition.
.2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
.3 Visually inspect enclosures at beginning of each working period.
.4 Use smoke methods to test effectiveness of barriers when directed by Departmental Representative.

.7 Do not begin Asbestos Abatement Work until:
.1 Arrangements have been made for disposal of waste.
.2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.
.3 Work areas and decontamination enclosures and parts of building required to remain in use are effectively segregated.
.4 Tools, equipment, and Materials waste containers are on hand.
.5 Arrangements have been made for building security.
.6 Warning signs are displayed where access to contaminated areas is possible.
.7 Notifications have been completed and other preparatory steps have been taken.

3.2 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos containing Materials.

3.3 ASBESTOS REMOVAL

.1 Before removing asbestos:
.1 Prepare site.

.2 Spray asbestos Material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos Material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos Material repeatedly during Work process to maintain saturation and to minimize asbestos fibre dispersion.

.2 Remove saturated asbestos Material in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack Material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping Work, wire brushed and wet sponged surfaces from which asbestos has been removed to remove visible Material. During this Work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible asbestos, and after encapsulating asbestos containing Material impossible to remove, wet clean entire Work area including Equipment and Access Room, and equipment used in process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of Work area. Allow at least 16 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.

.6 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.7 Cleanup:

.1 Frequently during Work and immediately after completion of Work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of Material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.4 FINAL CLEANUP

.1 Following cleaning, and when air sampling by Departmental Representative shows that asbestos levels on both sides of seals do not exceed 0.01 fibres/cc as determined by phase contrast microscopy, as described in NIOSH Method 7400 or equivalent, proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls towards the centre of the Work area. Vacuum visible asbestos containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning Material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.

.5 Include in clean-up sealed waste containers and equipment used in Work and remove from Work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.

.7 As Work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

3.5 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 When cleanup is complete:
  .1 Re-establish objects and furniture moved to temporary locations in course of Work, in their proper positions.
  .2 Re-secure mounted objects removed in course of Work in their former positions.
  .3 Re-establish mechanical and electrical systems in proper working order. Install new filters.
  .4 Repair or replace objects damaged in the course of Work, as directed by Departmental Representative.

3.6 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, Departmental Representative will collect air samples on daily basis in the clean room and outside of Work area enclosure(s) in accordance with industry standard practice.

.2 If air monitoring shows that areas outside the Work area or in the clean room area are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Areas.
  .1 Stop Work and clean areas outside of Asbestos Work Areas when Phase Contrast Microscopy measurements exceed 0.05 fibres per cubic centimetre (f/cc) and correct procedures.
  .2 All required cleaning, re-cleaning, additional air testing and/or inspections will be at no extra charge to Departmental Representative.

.3 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection by Departmental Representative, and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Departmental Representative will perform aggressive air monitoring within Asbestos Work Area.
  .1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.
  .2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean Work area and apply another acceptable coat of lock-down agent to surfaces.
  .3 Repeat as necessary until fibre levels are less than 0.01 f/cc.
  .4 No additional costs will be allowed by Contractor for additional labour or Materials required to provide specified performance level.

3.7 INSPECTION

.1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by Departmental Representative may result in Work stoppage, at no cost to the Departmental Representative.

.2 Departmental Representative will inspect Work for:
- .1 Adherence to specific procedures and Materials.
- .2 Final cleanliness and completion.
- .3 No additional costs will be allowed by Contractor for additional labour or Materials required to provide specified performance level.

.3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Departmental Representative may order Work shutdown.
- .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing the following Work: Type 1 Operation.
- .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap on walls.
- .2 Removal of lead-containing coatings or Materials using a power tool with an effective dust collection system equipped with a HEPA filter on walls.
- .3 Removal of lead-containing coatings or Materials with non-powered hand tool, other than manual scraping and sanding on walls.

1.2 REFERENCES

.1 Department of Justice Canada.
- .1 Canadian Environmental Protection Act (CEPA), 1999.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 WHIMS Safety Data Sheets (SDS).

.3 Human Resources and Social Development Canada (HRSDC)
- .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.4 Transport Canada (TC).
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Ontario Ministry of Environment, Conservation and Parks(MOECP).
- .1 R.R.O. 1990, Reg. 347, General – Waste Management, as amended.

.6 Ontario Ministry of Labour, Training, and Skills Development (MoLTSD).
- .1 Occupational Health and Safety Act, R.S.O. 1990, c. O.1 (OHSA).
  - .1 O.Reg. 213/91, Construction Projects.
  - .2 R.R.O. 1990, Regulation 490/09, “Designated Substances”.
- .2 Guideline: Lead on Construction Projects, September 2004, as revised.

.7 Canada Consumer Product Safety Act Surface Coating Materials Regulations SOR/2005-109, as amended.

1.3 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representatives.

.3 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.

.4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of Work.

.5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic meter of air (50 ug/m^3) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic meter of air for removal of lead-containing paint by methods noted in paragraph 1.1.

.6 Competent person: Departmental Representative capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.

.7 Lead dust: wipe sampling on vertical surfaces and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

1.3 SUBMITTALS

.1 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead-containing paint waste in accordance with requirements of authority having jurisdiction.

.2 Provide proof of Contractor's General and Environmental Liability Insurance.

.3 Quality Control:

.1 Provide Departmental Representative necessary permits for transportation and disposal of lead-containing paint waste and proof that lead-containing paint waste has been received and properly disposed.

.2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of Work procedures and protective measures.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead-containing , provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time Work is performed.

.2 Health and Safety:
.1 Safety Requirements: worker and visitor protection.
.1 Protective equipment and clothing to be worn by workers and visitors in Work Area include:
.1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters.
.2 Half mask respirator: half-mask particulate respirator with N - series filter, and 95% efficiency could be provided.
.2 Eating, drinking, chewing, and smoking are not permitted in Work area.
.3 Ensure workers wash hands and face when leaving Work area. Facilities for washing are determined by the Departmental Representative.
.4 Visitor Protection:
.1 Provide approved respirators to Authorized Visitors to Work areas.
.2 Instruct Authorized Visitors procedures to be followed in entering and exiting Work area.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse and recycling.

.2 Handle and dispose of hazardous Materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm thick bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.6 EXISTING CONDITIONS

.1 Various paints and surface coatings contain detectable concentrations of lead.

.2 Refer to the following for details on lead-containing Materials:
.1 Project Specific Designated Substance Survey, Search and Rescue Station, Port Weller, Ontario. Prepared by DST Consulting Engineers Inc. February 21, 2018.
.2 Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station Port Weller ON. Prepared by Stantec Consulting Ltd. and dated June 19, 2018.
.3 Section 02 81 01.01 Schedule A Hazardous Materials Table.

.3 Notify Departmental Representative of lead-containing Materials discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such Material pending instructions from Departmental Representative.

1.7 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify following in writing:
- .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
- .2 Provincial MOLTSD.
- .3 Disposal Authority.

.2 Inform sub trades of presence of lead-containing Materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

.4 Hours of Work: perform Work involving lead abatement at hours specified by the Departmental Representative. Include in Contract additional costs due to this requirement.

1.8 INSTRUCTIONS

.1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of Work procedures, and in use, cleaning, and disposal of respirators.

.2 Instruction and training related to respirators includes, at minimum:
- .1 Proper fitting of equipment.
- .2 Inspection and maintenance of equipment.
- .3 Disinfecting of equipment.
- .4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Supervisory personnel to complete required training.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Polyethylene 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.

.2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.3 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual lead paint residue.

.4 Lead waste containers: metal type acceptable to dump operator with tightly fitting covers and 0.15 mm thickness sealable polyethylene liners.
.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

PART 3 - EXECUTION

3.1 SUPERVISION

.1 One Supervisor for every ten workers is required.

.2 Supervisor must remain within Work area during disturbance, removal, or handling of lead-containing paints.

3.2 PREPARATION

.1 Remove and store items to be salvaged or reused.
.1 Protect and wrap items and transport and store in area specified by Departmental Representative.

.2 Work Area:
.1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct Work is airtight.
.2 Pre-clean fixed casework and equipment within Work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.
.3 Clean Work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.
.4 Seal off openings with polyethylene sheeting and seal with tape.
.5 Protect floor surfaces covered from wall to wall with polyethylene sheets.
.6 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.
.7 Where water application is required for wetting lead containing Materials, provide temporary water supply appropriately sized for application of water as required.
.8 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment.

.3 Do not start Work until:
.1 Arrangements have been made for disposal of waste.
.2 Tools, equipment, and Materials waste containers are on site.

.3 Arrangements have been made for building security.
.4 Notifications have been completed and preparatory steps have been taken.

3.3 LEAD ABATEMENT

.1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap; or removal equipped with HEPA filters; or removal with using power tools, non-powered hand tool, other than manual scraping and sanding.

.2 Remove lead-containing paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping Work, wire brush and wet sponge surface from which lead-containing paint has been removed to remove visible Material. During this Work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible lead-containing paint, wet clean entire Work area, and equipment used in process. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of Work area. Do not disturb Work area for 8 hours no entry, activity, ventilation, or disturbance during this period.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in Work stoppage, at no cost to the Departmental Representative.

.2 Departmental Representative will inspect Work for:
.1 Adherence to specific procedures and Materials.
.2 Final cleanliness and completion.
.3 No additional costs will be allowed by Contractor for additional labour or Materials required to provide specified performance level.

3.5 LEAD SAMPLING - WORK AREAS

.1 From beginning of Work until completion of cleaning operations, the Departmental Representative may be on site to collect air samples either inside or outside of the Lead Work Area in accordance with standard methods for workplace air sampling and analysis.

.1 This air monitoring does not relieve the Contractor of any responsibility for air monitoring inside the Lead Work Area to verify that the respiratory protection in use provides a suitable protection factor.

.2 Use results of air monitoring inside the Lead Work Area to establish type of respirators to be used. Workers may be required to wear sample pumps for up two full-shift periods.

.1 If airborne lead concentrations are above the protection factor of respirators in use, the Contractor shall:

.1 Stop abatement.

.2 Introduce more stringent engineering controls.

.3 Use a higher protection factor in respiratory protection for persons inside the Lead Work Area.

.2 If air monitoring shows that airborne lead concentrations outside the Lead Work Area exceed 0.025 mg/m³, the Contractor shall maintain and clean these areas, in same manner as applicable to the Lead Work Area, at no additional cost to the Departmental Representative.

.3 Final clearance air monitoring will be performed at the sole discretion of the Departmental Representative.

.1 Final air monitoring results must show airborne lead levels less than 0.005 mg/m³.

.2 If air monitoring results show airborne lead levels in excess of 0.005 mg/m³, the Contractor shall re-clean the Lead Work Area at no additional cost to the Departmental Representative.

.3 Repeat as necessary until airborne lead levels are less than 0.005 mg/m³.

.4 The following criteria shall be used to define an acceptable level of cleanliness after lead abatement activities:

.1 Where removal of paints and other surface coatings has been performed to accommodate the project scope of Work:

.1 Visibly free of paint(s), primer(s), and surface coating(s), and/or associated dust.

.2 Residual lead dust concentration less than:

.1 430 micrograms/square metre for interior floor surfaces

.2 2,691 micrograms/square metre for interior windowsills

.3 8,611 micrograms/square metre for exterior surfaces

.4 Repeat cleaning as necessary until lead concentrations are below specified levels, at no additional cost to the Departmental Representative.

3.6 FINAL CLEANUP

.1 Following cleaning and when lead wipe surfaces sampling are below acceptable concentrations, proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls towards the centre of Work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.

.3 Place polyethylene sheets, tape, cleaning Material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

.5 Repair or replace objects damaged in course of Work to their original state or better, as directed by Departmental Representative.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work: Type 2 Operation.
- .1 Removal or disturbance of lead-containing paint by scraping or sanding using non-powered hand tools.
- .2 Manual demolition of lead-containing paint coated building components by striking wall with sledgehammer or similar tool.

1.2 SECTION INCLUDES

.1 Requirements and procedures for disturbance or abatement of lead-containing paints.

1.3 REFERENCES

.1 Department of Justice Canada.
- .1 Canadian Environmental Protection Act (CEPA), 1999.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Safety Data Sheets (SDS).

.3 Human Resources and Social Development Canada (HRSDC)
- .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.4 Transport Canada (TC).
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Ontario Ministry of the Environment, Conservation, and Parks(MECP).
- .1 R.R.O. 1990, Reg. 347, General – Waste Management, as amended.

.6 Ontario Ministry of Labour, Training, and Skills Development (MOLTSD).
- .1 Occupational Health and Safety Act, R.S.O. 1990, c. O.1 (OHSA).
  - .1 O.Reg. 213/91, Construction Projects.
  - .2 R.R.O. 1990, Regulation 490/09, “Designated Substances”.
- .2 Guideline: Lead on Construction Projects, September 2004, as revised.

.7 Canada Consumer Product Safety Act Surface Coating Materials Regulations SOR/2005-109, as amended.

.8 Environment Council of Ontario (EACO)
- .1 Lead Guideline for Construction, Renovation, Maintenance or Repair, October 2014.

1.4 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representatives and representatives of regulatory agencies.

.3 Occupied Area: areas of building or Work site that is outside Work Area.

.4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of Work.

.5 Airlock: ingress or egress system, without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.

.6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows:
.1 Place two overlapping polyethylene sheets over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway, and secure other sheet along opposite vertical side of doorway.
.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.
.3 Overlap each polyethylene sheet at openings 1.5 m on each side.

.7 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic meter of air calculated as 8 hour time-weighted average (TWA). Intermediate precautions for lead abatement are based on airborne lead concentrations greater than 0.05 milligrams per cubic meter of air within Work Area.

.8 Competent Person: Departmental Representative capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.9 Lead in Dust: wipe sampling on vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

1.5 SUBMITTALS

.1 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead-containing paint waste in accordance with requirements of authority having jurisdiction.

.2 Provide: Provincial and local requirements for Notice of Project Form.

.3 Provide proof of Contractor's General and Environmental Liability Insurance.

.4 Quality Control:
.1 Provide Departmental Representative necessary permits for transportation and disposal of lead-containing paint waste and proof that it has been received and properly disposed.
.2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of Work procedures and protective measures.
.3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.5 Product data:
.1 Provide documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for chemicals or Materials including:
.1 Encapsulants.
.2 Amended water.
.3 Slow drying sealer.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time Work is performed.

.2 Health and Safety:
.1 Safety Requirements: worker and visitor protection.
.1 Protective equipment and clothing to be worn by workers and visitors in Work Area includes:
.1 Respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.
.2 Disposable type protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.
.2 Requirements for workers:
.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering

Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving Work area. Place contaminated Work suits in receptacles for disposal with other lead - contaminated Materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in Work Area, store Work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from Work Area or from Equipment and Access Room.

.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not to use this system as means to leave or enter work area.

.3 Eating, drinking, chewing, and smoking are not permitted in Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.

.5 Ensure workers wash hands and face when leaving Work Area. Facilities for washing are located as indicated by the Departmental Representative.

.6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.7 Ensure no Person required to enter Work Area has facial hair that affects seal between respirator and face.

.8 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to Work Areas.

.2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse and recycling.

.2 Handle and dispose of hazardous Materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm thick bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Various paints and surface coatings contain detectable concentrations of lead.

.2 Refer to the following for details on lead-containing Materials:
.1 Project Specific Designated Substance Survey, Search and Rescue Station, Port Weller, Ontario. Prepared by DST Consulting Engineers Inc. February 21, 2018.
.2 Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station Port Weller ON. Prepared by Stantec Consulting Ltd. and dated June 19, 2018.
.3 Section 02 81 01.01 Schedule A Hazardous Materials Table.

.3 Notify Departmental Representative of lead-containing Material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such Material pending instructions from Departmental Representative.

1.9 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify the following in writing, where appropriate:
.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
.2 Provincial Ministry of Labour.
.3 Disposal Authority.

.2 Inform sub trades of presence of lead-containing Materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.

.5 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.
.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

PART 3 - EXECUTION

3.1 SUPERVISION

.1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead-containing paints.

3.2 PREPARATION

.1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.

.2 Work Area:
.1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct Work is airtight.
.2 Pre-clean fixed casework, and equipment within Work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
.3 Clean Work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.
.4 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
.5 Cover floor surfaces in Work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.
.6 Build airlocks at entrances and exits from Work areas to ensure Work areas are always closed off by one curtained doorway when workers enter or exit.
.7 At point of access to Work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:
.1 CAUTION LEAD HAZARD AREA (25 mm).
.2 NO UNAUTHORIZED ENTRY (19 mm).
.3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).
.4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).
.8 Maintain emergency and fire exits from Work areas, or establish alternative exits satisfactory to Authority having jurisdiction.

.9 Where water application is required for wetting lead containing Materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.

.10 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.3 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:

.1 Equipment and Access Room: construct between exit and Work areas, with two curtained doorways, one to the rest of suite, and one to Work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in Work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.

.2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.4 Construction of Decontamination Enclosures:

.1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.

.2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.5 Separation of Work Areas from Occupied Areas

.1 Barriers between Work Area and occupied area to be constructed as follows:

.1 Construct floor to ceiling lumber stud framing, cover with polyethylene sheeting and seal with duct tape. Apply plywood over polyethylene sheeting. Seal plywood joints and between adjacent Materials with surface film forming sealer, to create airtight barrier.

.2 Cover plywood with polyethylene sheeting and sealed with duct tape.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in clean condition.

.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.

.3 Visually inspect enclosures at beginning of each Work day.

.4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

3.3 LEAD – CONTAINING PAINT ABATEMENT

.1 Removal of lead-containing paint to be performed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted building components by striking a wall with sledgehammer or similar tool.

.2 Remove lead-containing paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping Work, wire brush and wet sponge surface from which lead-containing paint has been removed to remove visible Material. During this Work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible lead-containing paint, wet clean Work area including equipment and access room, and equipment used in process. After inspection by Departmental Representative, apply continuous coat of slow drying sealer to surfaces. Do not disturb Work for 8 hours with no entry, activity, ventilation or disturbance during this period.

.6 Wet clean Work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in Work stoppage, at no cost to Departmental Representative.

.2 Departmental Representative will inspect Work for:
- .1 Adherence to specific procedures and Materials.
- .2 Final cleanliness and completion.
- .3 No additional costs will be allowed by Contractor for additional labour or Materials required to provide specified performance level.

.3 When lead dust leakage from Work Area occurs Departmental Representative may order Work shutdown.

.1 No additional costs will be allowed by Contractor for additional labour or Materials required to provide specified performance level.

3.5 LEAD SAMPLING - WORK AREAS

.1 From beginning of Work until completion of cleaning operations, the Departmental Representative may be on site to collect air samples either inside or outside of the Lead Work Area in accordance with standard methods for workplace air sampling and analysis.
.1 This air monitoring does not relieve the Contractor of any responsibility for air monitoring inside the Lead Work Area to verify that the respiratory protection in use provides a suitable protection factor.

.2 Use results of air monitoring inside the Lead Work Area to establish type of respirators to be used. Workers may be required to wear sample pumps for up two full-shift periods.
.1 If airborne lead concentrations are above the protection factor of respirators in use, the Contractor shall:
.1 Stop abatement.
.2 Introduce more stringent engineering controls.
.3 Use a higher protection factor in respiratory protection for Persons inside the Lead Work Area.
.2 If air monitoring shows that airborne lead concentrations outside the Lead Work Area exceed 0.025 mg/m³, the Contractor shall maintain and clean these areas, in same manner as applicable to the Lead Work Area, at no additional cost to the Departmental Representative.

.3 Final clearance air monitoring will be performed at the sole discretion of the Departmental Representative.
.1 Final air monitoring results must show airborne lead levels less than 0.005 mg/m³.
.2 If air monitoring results show airborne lead levels in excess of 0.005 mg/m³, the Contractor shall re-clean the Lead Work Area at no additional cost to the Departmental Representative.
.3 Repeat as necessary until airborne lead levels are less than 0.005 mg/m³.

.4 The following criteria shall be used to define an acceptable level of cleanliness after lead abatement activities:
.1 Where removal of paints and other surface coatings has been performed to accommodate the project scope of Work:
.1 Visibly free of paint(s), primer(s), and surface coating(s), and/or associated dust.
.2 Residual lead dust concentration less than:
.1 430 micrograms/square metre for interior floor surfaces
.2 2,691 micrograms/square metre for interior windowsills
.3 8,611 micrograms/square metre for exterior surfaces

.4 Repeat cleaning as necessary until lead concentrations are below specified levels, at no additional cost to the Departmental Representative.

3.6 FINAL CLEANUP

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of Work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning Material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Clean-up Work Areas, Equipment and Access Room, and other contaminated enclosures.

.5 Clean-up sealed waste containers and equipment used in Work and remove from Work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

.7 Repair or replace objects damaged in course of Work to their original state or better, as directed by Departmental Representative.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing the following Work:
- .1 Removal or disturbance of lead-containing paint using power tools with an effective dust collection system equipped with HEPA filter.
- .2 Abrasive blasting of lead-containing based paint.
- .3 Removal of lead-containing dust using air mist extraction system.

1.2 REFERENCES

.1 Department of Justice Canada.
- .1 Canadian Environmental Protection Act (CEPA), 1999.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Safety Data Sheets (SDS).

.3 Human Resources and Social Development Canada (HRSDC)
- .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.4 Transport Canada (TC).
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Ontario Ministry of the Environment, Conservation, and Parks(MECP).
- .1 R.R.O. 1990, Reg. 347, General – Waste Management, as amended.

.6 Ontario Ministry of Labour, Training, and Skills Development (MoLTSD).
- .1 Occupational Health and Safety Act, R.S.O. 1990, c. O.1 (OHSA).
  - .1 O.Reg. 213/91, Construction Projects.
  - .2 R.R.O. 1990, Regulation 490/09, “Designated Substances”.
- .2 Guideline: Lead on Construction Projects, September 2004, as revised.

.7 Canada Consumer Product Safety Act Surface Coating Materials Regulations SOR/2005-109, as amended.

1.3 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representatives of regulatory agencies.

.3 Occupied Area: area of building or work site outside Work Area.

.4 Dioctyl Phthalate (DOP) Test: testing method used to evaluate particle penetration and air flow resistance properties of filtration Materials - HEPA filter leak test.

.5 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Appropriate capacity for scope of work.

.6 Airlock: ingress or egress system without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.

.7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:

.1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings 1.5 m on each side.

.8 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic metre of air calculated as an 8-hour time-weighted average (TWA). Maximum precautions for lead abatement are based on airborne lead concentrations greater than 1.25 milligrams per cubic meter of air within Work Area.

.9 Competent Person: Individuals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.10 Lead in Dust: wipe sampling on the vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

.11 Negative Air Pressure Machine: extracts air directly from work area and filters extracted air through a HEPA filter, discharge air to exterior of building.

.1 Maintain pressure differential of 5 to 7 Pa relative to adjacent areas outside of the Work Area. Machine to be equipped with alarm to warn of system breakdown, and equipped with instrument to continuously monitor and automatically record pressure differences.

1.4 SUBMITTALS

.1 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead-containing paint waste in accordance with requirements of authority having jurisdiction.

.2 Provide: Provincial and local requirements for Notice of Project Form.

.3 Provide proof of Contractor's General and Environmental Liability Insurance.

.4 Quality Control:
.1 Provide Departmental Representative necessary permits for transportation and disposal of lead-containing paint waste and proof it has been received and properly disposed.
.2 Provide proof satisfactory to Departmental Representative that employees had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.
.3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.5 Product data:
.1 Provide documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for chemicals or Materials including:
.1 Encapsulants.
.2 Amended water.
.3 Slow drying sealer.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead, in case of conflict among those requirements or with these specifications the more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:
.1 Safety Requirements: worker and visitor protection.
.1 Protective equipment and clothing to be worn by workers while in Lead Work Area includes:
.1 Lead-containing paint removal using power tool: respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.
.2 Abrasive blasting of lead paint: NIOSH approved and equipped with filter cartridges with assigned protection factor of 1000, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Respirator to be equivalent Type CE abrasive blast supplied air respirator operated in a pressure demand

or positive pressure mode with a tight-fitting half-mask. Compressed air used to supply supplied air respirators to meet breathing air purity requirements of CAN/CSA-Z180.1.

.3 Disposable protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.2 Requirements for workers:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving the Work Area. Place contaminated work suits in receptacles for disposal with other lead contaminated Materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in the Work Area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from the Work Area or from Equipment and Access Room.

.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not use this system as means to leave or enter Work Area.

.2 Eating, drinking, chewing, and smoking are not permitted in Work Area.

.3 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.

.4 Ensure workers wash hands and face when leaving Lead Work Area. Facilities for washing are located as indicated by the Departmental Representative

.5 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.6 Ensure no Person required to enter the Work Area has facial hair that affects seal between respirator and face.

.7 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to the Work Areas.

.2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste Materials for reuse and recycling.

.2 Handle and dispose of hazardous Materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm thick bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

.1 Various paints and surface coatings contain detectable concentrations of lead.

.2 Refer to the following for details on lead-containing Materials:

.1 Project Specific Designated Substance Survey, Search and Rescue Station, Port Weller, Ontario. Prepared by DST Consulting Engineers Inc. February 21, 2018.

.2 Designated Substances and Hazardous Building Materials Assessment – North Storage Shed and North Storage Bin, Port Weller Search and Rescue Station Port Weller ON. Prepared by Stantec Consulting Ltd. and dated June 19, 2018.

.3 Section 02 81 01.01 Schedule A Hazardous Materials Table.

.3 Notify Departmental Representative of lead-containing Material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such Material pending instructions from Departmental Representative.

1.8 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify the following in writing; where appropriate.

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Ministry of Labour, Training, and Skills Development (MoLTSD).

.3 Disposal Authority.

.2 Inform sub trades of presence of lead-containing Materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

.4 Hours of Work: perform work involving lead abatement located the Building at hours specified by the Departmental Representative. Include in Contract additional costs due to this requirement.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Polyethylene 0.15 mm unless otherwise specified; in sheet size minimize joints.

.2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.

.5 Lead waste containers: metal type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

PART 3 - EXECUTION

3.1 SUPERVISION

.1 Approved Supervisor must remain within Work Area during disturbance, removal, or handling of lead-containing paints.

3.2 PREPARATION

.1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent lead dust and particulate dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.2 Pre-clean fixed casework, and equipment within Work Areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.3 Clean Work Areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.

.4 Install negative pressure machine system and operate continuously from installation of polyethylene sheeting until completion of final cleanup. Provide automatic continuous monitoring and recording instrument of pressure difference.

.5 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.6 Cover floor surfaces in Work Areas from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.

.7 Build airlocks at entrances and exits from Work Areas to ensure Work Areas are always closed off by one curtained doorway when workers enter or exit.

.8 At point of access to Work Areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:

.1 CAUTION LEAD HAZARD AREA (25 mm).

.2 NO UNAUTHORIZED ENTRY (19 mm)

.3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).

.4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).

.9 Maintain emergency and fire exits from Work Areas, or establish alternative exits satisfactory to Authority having jurisdiction.

.10 Where water application is required for wetting lead containing Materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.

.11 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.3 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:

.1 Equipment and Access Room: construct between exit and Work Areas, with two curtained doorways, one to the rest of the suite, and one to Work Areas. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in Work Areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.

.2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.4 Construction of Decontamination Enclosures:

.1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.

.2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closure comprising doorway always remains closed.

.3 Shower room in decontamination facility to be provided with the following:

.1 Hot and cold water or water of constant temperature not less than 40 degrees Celsius or more than 50 degrees Celsius.

.2 Individual controls inside to regulate water flow and temperature.

.4 Prior to each shift in which a decontamination facility is being used, a competent Person should inspect the facility to ensure that there are no defects that would allow lead-containing dust to escape. Defects should be repaired before the facility is used. The decontamination facility should be maintained in a clean and sanitary condition.

.5 Separation of Work Areas from Occupied Areas:

.1 Barriers between Work Area and occupied area to be constructed as follows:

.1 Construct floor to ceiling lumber stud framing, cover with polyethylene sheeting and seal with duct tape. Apply plywood over polyethylene sheeting. Seal plywood joints and between adjacent Materials with surface film forming sealer, to create airtight barrier.

.2 Cover plywood with polyethylene sheeting and sealed with duct tape.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in tidy condition.

.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.

.3 Visually inspect enclosures at beginning of each working day.

.4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

3.3 LEAD – CONTAINING PAINT ABATEMENT

.1 Removal of lead-containing paint to be performed using power tools that are attached to dust-collecting vacuums with HEPA filters.

.2 Remove lead-containing paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Wet method to be used to reduce dust generation. Examples of wet methods include wetting surfaces, wet scraping, and wet shoveling. Wet method not be used if it creates a hazard or cause damage to equipment or to project. Power tools to be equipped with a shroud, and to be kept flush with surface.

.4 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove immediate from working area to staging area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.5 After completion of stripping work, wire brush and wet sponge surface to remove visible Material. During this work keep surfaces wet. After wire brushing and wet sponging, wet clean and HEPA vacuum entire Work Area including Equipment and Access Room. Compressed air or dry sweeping not be used to clean up lead-containing dust or waste. After inspection and approval by Departmental Representative apply continuous coat of slow drying sealer to surfaces. Do not disturb Work Area for 8 hours, no entry, activity, or ventilation other than operation negative air machine during this period.

.6 After enclosing lead painted surfaces, wet clean Work Area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from requirements not been approved in writing by Departmental Representative will result in Work shutdown, at no cost to the Departmental Representative.

.2 Departmental Representative will inspect work for:
- .1 Adherence to specific procedures and Materials.
- .2 Final cleanliness and completion.
- .3 No additional costs will be allowed for additional labour or Materials required to provide specified performance level.

.3 When lead dust leakage from Work Area occurs Departmental Representative will order Work shutdown.
- .1 No additional costs will be allowed by Contractor for additional labour or Materials required to provide specified performance level.

3.5 LEAD SAMPLING - WORK AREAS

.1 From beginning of Work until completion of cleaning operations, the Departmental Representative may be on site to collect air samples either inside or outside of the Lead Work Area in accordance with standard methods for workplace air sampling and analysis.
- .1 This air monitoring does not relieve the Contractor of any responsibility for air monitoring inside the Lead Work Area to verify that the respiratory protection in use provides a suitable protection factor.

.2 Use results of air monitoring inside the Lead Work Area to establish type of respirators to be used. Workers may be required to wear sample pumps for up two full-shift periods.

.1 If airborne lead concentrations are above the protection factor of respirators in use, the Contractor shall:

.1 Stop abatement.

.2 Introduce more stringent engineering controls.

.3 Use a higher protection factor in respiratory protection for Persons inside the Lead Work Area.

.2 If air monitoring shows that airborne lead concentrations outside the Lead Work Area exceed 0.025 mg/m³, the Contractor shall maintain and clean these areas, in same manner as applicable to the Lead Work Area, at no additional cost to the Departmental Representative.

.3 Final clearance air monitoring will be performed at the sole discretion of the Departmental Representative.

.1 Final air monitoring results must show airborne lead levels less than 0.005 mg/m³.

.2 If air monitoring results show airborne lead levels in excess of 0.005 mg/m³, the Contractor shall re-clean the Lead Work Area at no additional cost to the Departmental Representative.

.3 Repeat as necessary until airborne lead levels are less than 0.005 mg/m³.

.4 The following criteria shall be used to define an acceptable level of cleanliness after lead abatement activities:

.1 Where removal of paints and other surface coatings has been performed to accommodate the project scope of Work:

.1 Visibly free of paint(s), primer(s), and surface coating(s), and/or associated dust.

.2 Residual lead dust concentration less than:

.1 430 micrograms/square metre for interior floor surfaces

.2 2,691 micrograms/square metre for interior windowsills

.3 8,611 micrograms/square metre for exterior surfaces

.4 Repeat cleaning as necessary until lead concentrations are below specified levels, at no additional cost to the Departmental Representative.

3.6 FINAL CLEANUP

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls towards the centre of Work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.

.3 Place polyethylene sheets, tape, cleaning Material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Clean up Work Areas, Equipment and Access Room, and other contaminated enclosures.

.5 Remove sealed waste containers and equipment used in Work and remove from Work areas at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remain on surfaces as result of dismantling operations.

.7 Repair or replace objects damaged in course of Work to their original state or better, as directed by Departmental Representative.

END