



Public Works and Government Services Canada

Requisition No. _____


SPECIFICATIONS

For Pleasant Camp Port of Entry
Tender A
Site Services and Site Services Building

Project No.
R.071363.001

February, 2015

APPROVED BY:



Regional Manager, AES

2015-03-03

Date

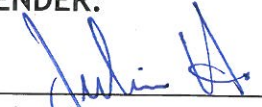


Construction Safety Coordinator

2015-03-02

Date

TENDER:



Project Manager

2015-03-03

Date


RM - ENVIRONMENT.
MARCH 03/2015.

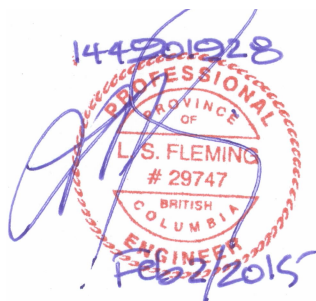
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G-002	General	Code Summary and Assemblies
G-003	General	Existing Site Buildings and Underground Services Plan
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S-301	Structural	Sections
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F-008	Fuel Systems	Electrical Schematics and Details
M001	Mechanical	Mechanical Site Plan and Legend
M002	Mechanical	Mechanical Detailed Demo & New Site Plan
M101	Mechanical	Site Services Building
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M701	Mechanical	Schedules & Controls Schematics
E101	Electrical	Site Plan – Existing Shallow Utilities Plan and Minor Modifications
E102	Electrical	Site Plan - Utilities Plan
E103	Electrical	Site Plan – Heat Trace
E201	Electrical	Site Services Building Plan
E202	Electrical	Site Services Building Details
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SR-003	Soils Remediation	Approximate Limit of Remedial Excavation and Proposed Future Port Facility Layout

End of Section

Part 1 General

1.1 CODES

- .1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments up to the TENDER closing date .

1.2 DESCRIPTION OF WORK

- .1 Work of this Contract covers the construction of the Site Services Building and new Site Services and demolition of existing buildings and structures and contaminated soils remediation, located at Pleasant Camp, British Columbia; and further identified as Pleasant Camp Port of Entry - Tender A - Site Services and Site Services Building.
- .2 Canada Border Services Agency (CBSA) in its mandate under the Customs Act operates the Pleasant Camp Port of Entry providing integrated border services including the processing of travellers into and out of Canada. The Port including the Port of Entry Building, staff housing and electrical, fuel, water and other facilities must remain fully operational throughout the project duration, unless otherwise indicated.
- .3 Work in this Contract comprises construction of new site services including water, power, communication, fire alarm, and fuel oil; construction of a new Site Services Building; demolition of existing structures and infrastructure and site remediation as indicated on the drawings and specifications including, but not limited to the following:
 - .1 Mobilization and demobilization of all personnel, equipment, support facilities, and materials to complete the work.
 - .2 Dismantling and demolition of buildings and infrastructure, segregating hazardous and non-hazardous materials.
 - .3 Collection and containerization of hazardous materials for disposal.
 - .4 Scheduling of all work including demolition, hazardous material abatement, new construction, installation of new services, commissioning, and soil remediation as required so that the Port of Entry Building and the staff housing remain operational at all times during construction.
 - .5 Ensuring that the existing water and electrical services to existing buildings are not compromised while new water, fuel, power and communication services and systems are constructed.
 - .6 Ensuring that the existing fuel tanks on site are kept full to ensure that the site heating systems and generator power fuel systems remain operational at all times.
 - .7 Construction of the new Site Services Building including excavation and backfill, foundation, structural and building envelope, and new building mechanical and electrical services.
 - .8 Construction of a new well house.
 - .9 Construction of a new rockpit.
 - .10 Provision of new electrical services and systems including but not limited to new buried services, generator, buried secondary power from transformer to Site Services Building, buried communication services, above ground power fire alarm and communication feed to existing Port of Entry Building, start-

- up and commissioning, relocation of existing CBSA/YTG antennae, new power feed to existing port highway gates, supply and installation of heat trace to water well and buried water lines, new power feed to water well.
- .11 Relocation of Owner supplied above grade primary fuel oil tank and appertenances from Whitehorse to Pleasant Camp, installation of the primary fuel oil tank and appurtenances, provision of new pumps, buried fuel pipe, sumps and leak detection, connection to the existing fuel oil sump at accomondation building 7/8, relocation of existing fuel oil tank and associated controls from House #9 to the new Site Services Building mechanical room, provision of new generator day tank, provision of new above grade fuel service to existing Port of Entry Building fuel oil tank, provision of new fuel supply to existing Maintenance Building fuel oil tank, provision of a concrete spill pad, provision of a new buried oil water separator, and start-up and commisioning of the new fuel oil services and systems.
- .12 Provision of new water services including connection to existing water well, provision of well pump, provision of buried insulated and heat traced water lines, provision of new water filtration and disinfection system, disinfection, start-up and commissioning of new water systems.
- .13 Remediation of contaminated soils on site including excavation, removal of contaminated soils off site and backfill and compaction of excavation.
- .4 Due to potential elevated noise levels during construction, schedule and coordinate work and interface with existing facilities with Departmental Representative. Contractor may be instructed to periodically to stop or reschedule work should construction activities impact CBSA operations.
- .5 The Contractor will be responsible for clearing snow on site if required to complete the Work and maintaining a safe and clean worksite
- .6 Green Requirement:
- .1 Use only environmentally responsible green materials/products with no VOC emissions or minimum VOC emissions of indoor off-gassing contaminants for improved indoor air quality - subject of Departmental Representative's approval of submitted MSDS Product Data.
- .2 Use materials/products containing highest percentage of recycled and recovered materials practicable - consistent with maintaining cost effective satisfactory levels of competition.
- .3 Adhere to waste reduction requirement for reuse or recycling of waste materials, thus diverting materials from landfill.

1.3 BACKGROUND INFORMATION

- .1 The Pleasant Camp Port of Entry is a Canada - US border crossing station located on the Haines Highway near the Canadian border at the Northwest corner of British Columbia in the Stikine region. Latitude and longitude coordinates are: 59deg 27min N, 136deg 22min W. The station elevation is 274.3 metres above sea level.
- .2 The nearest large community is Whitehorse, Yukon which is located 330 km NE of Pleasant Camp (approximately 4.5 hrs distance by road). Haines Alaska is located about 65km south of the site. The Pleasant Camp station includes four (4) duplex staff accommodation buildings and staff live and work at the site year round. The

Port operates from 0800hr to 24:00hrs.

- .3 The site is considered remote. There is no lodging or food at site.
- .4 Supporting documents pertaining to this site include, but are not limited to the following documents are included in the appendices;
 - .1 Appendix A: Geotechnical Reports
 - .1 "Geotechnical Evaluation - CBSA Port of Entry - Pleasant Camp, BC." prepared by Tetra-Tech EBA, dated December 9, 2014, file: W14103501-01.
 - .2 "Rock Pit Design and Site Backfill Recommendations - CBSA Port of Entry - Pleasant Camp, BC." prepared by Tetra_tech EBA, dated February 2, 2015, File W14103501-01.
 - .2 Appendix B: "FY 2012/2013 Building Conditions Assessment - CBSA Port of Pleasant Camp Border Crossing, Pleasant Camp, BC", prepared by SNC Lavalin Environment, dated March 31, 2013.
 - .3 Appendix C: "Hazardous Materials Assessment - Canada Border Services Agency - Pleasant Camp Port of Entry - Pleasant Camp, British Columbia", prepared by Golder Associates, dated February 14, 2007.
 - .4 Appendix D: Owner Supplied Equipment;
 - .1 Regal Tank Ltd. Invoice 17667 dated February 21, 2008. 3 pages detailing fuel oil tank equipment.
 - .2 Regal Tank Ltd. shop drawings - 4 pages dated Jan 23, 2008.
 - .3 Fuel tank Inspection Report prepared by Groundtrax Environmental Services Inc. dated September 8, 2014.
 - .5 Appendix E: Drawings - Existing buildings. Total 19 drawings. These are the only drawings available and are not considered complete.
 - .6 Appendix F: "FY 2013/2014 Annual Monitoring and Sampling Event, CBSA Port of Pleasant Camp, Pleasant Camp, BC", prepared by SNC-Lavalin Environmental dated March 31, 2014.
 - .7 Appendix G: "FY 2009/2010 Monitoring and Remediation Closure Report, CBSA Port of Pleasant Camp, Pleasant Camp, BC", prepared by SNC-Lavalin, March 31, 2010
 - .8 Appendix H: "Environmental Assessment for FY 2015/2016 Site Deconstruction and Remediation Activities, CBSA Port of Pleasant Camp, BC", prepared by SNC-Lavalin dated February 10, 2015
 - .9 Appendix I: "Geotechnical Investigation CBSA Port of Pleasant Camp Border Crossing, Pleasant Camp, British Columbia", prepared by SNC-Lavalin dated March 31, 2013.

1.4 SITE HAZARDS.

- .1 Site hazards that the Contractor should be aware of include, but are not limited to the following;
 - .1 Physical hazards of various structures and buildings.
 - .2 Fuels and lubricating fluids.
 - .3 Wildlife.
 - .4 Inclimate weather including extreme cold, rain and/or snow
 - .5 Remote site conditions.

- .6 Local vehicular traffic.
- .7 Hydrocarbon contaminated soils and groundwater.
- .8 Metals in groundwater
- .9 Complete list of anticipated contaminants and concentration levels on the Site are shown on the provided reports in the appendices.
- .10 Septic fields and associated contaminated soils.
- .11 Existing buried services including but not limited to power, communication, fuel and water services.
- .12 Hazardous materials including polychlorinated biphenyls (PCBs), lead paint, asbestos and mercury.
- .13 Existing buried high voltage service from south side of site to existing transformer.

1.5 SPECIAL PROCEDURES - TRAFFIC CONTROL

- .1 Provide appropriate signage and traffic cones to delineate the work area and not encroach on and impede traffic flow on the Haines Highway.
- .2 Use a flag person when moving vehicles on Site or when temporarily impeding traffic flow.

1.6 CONTRACT DOCUMENTS

- .1 The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

1.7 OTHER CONTRACTS

- .1 Further Contracts may be awarded while this Contract is in progress.
- .2 Cooperate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .3 Coordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of this Work.

1.8 DIVISION OF SPECIFICATIONS

- .1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.
- .2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.
- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

1.9 TIME OF COMPLETION

- .1 Complete the Pleasant Camp Port of Entry Site Services and Site Services Building project and be ready for use within 28 weeks after Contract Award.

1.10 HOURS OF WORK

- .1 Obey British Columbia Worksafe Regulations.
- .2 Duration of work day will be limited to 7am to 7pm unless otherwise approved in advance.
- .3 Work that may impact on CBSA Operations or the travelling public including work activities generating elevated noise levels shall be approved in advance and carried out during hours as directed.
- .4 Under no circumstances will work be allowed between 10PM and 7AM if noise level exceeds 40dBA at the residences (Existing Duplexes).
- .5 Notify Departmental Representative of all after hours work, including weekends and holidays.

1.11 WORK SCHEDULE

- .1 Carry on work as follows:
 - .1 Within 10 working days after Contract award, provide a "schedule gantt bar chart" showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Indicate the following:
 - .1 Submission of shop drawings, product data, MSDS sheets and samples.
 - .2 Commencement and completion of work of each section of the specifications or trade for each phase as outlined.
 - .3 Work initiation and final completion date within the time period required by the Contract documents.
 - .4 Take into consideration, amongst others;
 - .1 Restrictions due to continued operation of the Port of Entry facilities.
 - .2 Expected seasonal inclement weather and its effect on backfill and compaction operations.
 - .3 If required, plan and pay for any facilities and procedures to expedite sequence of work to meet the completion date.
 - .4 Commence soils remediation, excavation and backfill work by September 1, 2015 and complete by September 30, 2015.
 - .2 Do not change approved Schedule - without notifying Departmental Representative
 - .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.
 - .4 Post construction Submittals and As-Builts are to be finalized by December 1, 2015
- .2 Carry on Remediation Work as per indicated "PHASES" as follows:
 - .1 Phase 1 - Remedial Excavation, Backfilling, Compaction, and Restoration of Area 1.
 - .2 Phase 2 - Remedial Excavation, Backfilling, Compaction, and Restoration of Area 2 (time and budget permitting).

- .3 Phase 3 - Remedial Excavation, Backfilling, Compaction, and Restoration of Area 3 (time and budget permitting).
- .4 The Phases outlined above may be combined subject to approval by the Departmental Representative. Phases 2 and 3 will only be undertaken if sufficient funding is available and at the direction of the Departmental Representative.
- .3 After Hours Work:
 - .1 After hours work: at least 5 Working Days prior to commencing after hours work Submit a schedule showing requested dates, times, and reasons for after hours work. Approval will only be granted for reasons valid in the opinion of the Departmental Representative and if request can be reasonably accommodated by other contracts.

1.12 COST BREAKDOWN

- .1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum prices in detail as directed by the Departmental Representative and aggregating Contract price.

1.13 CODES, BYLAWS, STANDARDS

- .1 Perform work in accordance with the latest edition of the National Building Code of Canada (NBC), the National Fire Code of Canada (NFC), the Canadian Electrical Code of Canada (CEC), the National Plumbing Code of Canada (NPCC) and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.
- .2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned. These include:
 - .1 Pollution, waste, or garbage restrictions.
 - .2 Truck, traffic, and road access restrictions.
 - .3 Water, stormwater, and sewer restrictions.
 - .4 Noise restrictions.
 - .5 Signage, fencing, hoarding restrictions.
 - .6 Fire prevention restrictions
 - .7 Fuel equipment and storage restrictions.
- .3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
- .4 Obtain amendments to existing permits as required to complete the Work from authority having jurisdiction at no increase to the Contract Amount and no increase to Extension of Time for completion of the Work.
- .5 In any case of conflict or discrepancy, the most stringent requirements will apply.

1.14 DOCUMENTS REQUIRED

- .1 Maintain 1 copy each of the following at the job site:
 - .1 General Conditions.
 - .2 Contract drawings.
 - .3 Contract specifications.
 - .4 Addenda to Contract documents.
 - .5 Copy of approved work schedule.

- .6 Reviewed/approved shop drawings.
- .7 Change Orders.
- .8 Other modifications to Contract.
- .9 Field and laboratory test reports.
- .10 Reviewed/approved samples.
- .11 Manufacturers' installation and application instructions.
- .12 One set of record drawings and specifications for "as-built" purposes.
- .13 Field and laboratory test reports.
- .14 Reviewed and accepted Submissions.
- .15 National Building Code of Canada and National Fire Code of Canada.
- .16 Current construction Standards of workmanship listed in technical Sections.
- .17 Building Safety Plan.
- .18 Health and Safety documents, including all daily toolbox meetings, Notice of Project, and utility clearances.
- .19 Environmental Protection Plan.
- .20 Quality Management Plan.
- .21 Final Meeting Minutes, Agendas and associated attachments.
- .22 Permits and other approvals.

1.15 REGULATORY REQUIREMENTS

- .1 Obtain and pay for Building Permit, Certificates, Licenses and other permit required by regulatory municipal, provincial or federal authorities to complete the work.
- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.

1.16 CONTRACTOR'S USE OF SITE

- .1 Use of site:
 - .1 Exclusive and complete for execution of work, in work areas indicated but not including CBSA operational areas.
 - .2 Assume responsibility for assigned premises for performance of this work.
 - .3 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative.
- .2 Perform work in accordance with Contract documents. Ensure work is carried out as required to ensure continued operation of the site.
- .3 Do not unreasonably encumber site with material or equipment.
- .4 Accept liability for damage, safety of equipment and overloading of existing equipment.

1.17 EXAMINATION

- .1 Examine site and be familiar and conversant with existing conditions likely to affect work, including Contaminated Waste.
- .2 Be aware that there is significant buried services including live and previously abandoned services.
- .3 Provide photographs of surrounding properties, objects and structures liable to be

damaged or be the subject of subsequent claims.

1.18 EXISTING SERVICES

- .1 Notify Departmental Representative and Utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give departmental representative hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to vehicular traffic.
- .3 Provide alternative routes for personnel, pedestrian, and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify departmental representative of findings.
- .5 Submit schedule to and obtain approval from departmental representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services when directed by departmental representative to maintain critical building and tenant systems.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise departmental representative and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by department representative and/or authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.19 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 his approval for actual locations.
- .4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative.

1.20 CUTTING AND PATCHING

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove items so shown or specified.
- .3 Do not cut, bore, or sleeve load-bearing members.
- .4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.

- .5 Fit work airtight to pipes, sleeves ducts and conduits.
- .6 Conceal pipes, ducts and wiring in raised floors, wall and ceiling construction of finished areas except where indicated otherwise.
- .7 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.
- .8 Install firestops and smoke seals in accordance with ULC-S115, around pipe, ductwork, cables and other objects penetrating fire separations to provide fire resistance not less than the fire resistance of surrounding floor, ceiling and wall assembly.
- .9 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 metres in ambient light, and includes painting the whole surface to the next change in plane.

1.21 SETTING OUT OF WORK

- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needed to lay out and construct work.
- .3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.

1.22 ACCEPTANCE OF SUBSTRATES

- .1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to the Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.23 QUALITY OF WORK

- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman or Qualified Professional.
- .2 The workmanship, erection methods and procedures to meet minimum standards set out in the National Building Code of Canada and Construction Standards, as applicable for workmanship, erection methods and procedures.
- .3 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

1.24 QUALITY MANAGEMENT

- .1 Be responsible for all Quality Assurance and Quality Control during the performance of the Work.
- .2 Quality Assurance and Quality Control includes monitoring, inspecting, testing, documenting and reporting the means, methods, materials, workmanship, processes, and products of all aspects of the Work, including design, construction, and management as necessary to ensure conformance with the Contract.
- .3 Assist Departmental Representative in quality audit inspections and submit all indicated information within 5 Working Days of collection or as instructed.

1.25 WORKS COORDINATION

- .1 Coordinate work of subtrades

- .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
 - .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
 - .2 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
 - .1 Pay particular close attention to overhead work above ceilings and within or near to building structural elements.
 - .2 Identify on coordination drawings, building elements, service lines, rough-in points and indicate location services entrance to site.
 - .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
 - .4 Publish minutes of each meeting.
 - .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
 - .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
- .3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.
- .4 Work coordination:
 - .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
 - .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.
 - .3 Ensure disputes between subcontractors are resolved.
- .5 Failure to coordinate Work is responsibility of Contractor.
- .6 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.

1.26 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 In accordance with Section 013300, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.
- .2 Allow sufficient time for the following:
 - .1 Review of product data.
 - .2 Approval of shop drawings.
 - .3 Review of re-submission.
 - .4 Ordering of approved material and/or products - refer to Sections of Division 02 to 49.

1.27 RELICS AND ANTIQUITIES

- .1 Relics and antiquities and items of historical or scientific interest shall remain property of Department. Protect such articles and request directives from Departmental Representative.

- .2 Give immediate notice to Departmental Representative if evidence of archeological finds are encountered during excavation/construction, and await Departmental Representative's written instructions before proceeding with work in this area.

1.28 SECURITY CLEARANCES

- .1 Personnel will be checked at start of work shift and provided with pass which must be worn at all times.
- .2 Contractor shall be fully responsible for securing the premises and its contents throughout the construction period.

1.29 AS-BUILT DOCUMENTS

- .1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications, and 2 copies of the original AutoCAD files for "as-built" purposes.
- .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.

1.30 RECORD KEEPING

- .1 On Site Notifications: All correspondence from Contractor to the Departmental Representative, including Submittals, Quotes, and Extension Of Time On Contracts, must be as a sequentially numbered On Site Notifications. Include cross references to applicable On Site Instructions. The status of the Contractor, including the function of Prime Contractor, must not change by reason of any On Site Notifications.
- .2 On Site Instructions: All correspondence from the Departmental Representative to the Contractor, including Contemplated Change Notices, Change Orders, and Extension of Time on Contracts, will be as sequentially numbered On Site Instructions. Include cross references to applicable On Site Notifications. The status of the Contractor, including the function of Prime Contractor, must not change by reason of any On Site Instructions.
- .3 Maintain adequate records to support information provided to Departmental Representative.
- .4 Maintain asbestos waste shipment records or other Hazardous Waste Manifests for minimum of 3 years from date of shipment or longer period required by applicable law or regulation.
- .5 Maintain bills of ladings for minimum of 300 days from date of shipment or longer period required by applicable law or regulation.

1.31 CLEANING

- .1 Daily conduct cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
- .2 Maintain cleanliness of Work and surrounding Site to comply with federal, provincial, and municipal fire and safety laws, ordinances, codes, and regulations applicable to the performance of the Work.
- .3 Coordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials.
- .4 Ensure cleanup of the work areas each day after completion of work.
- .5 Ensure cleanup of roadways as needed or as directed by Departmental

Representative.

- .6 Clean interior building areas when ready to receive finish painting and continue cleaning on an as-needed basis until building is sufficiently completed or ready for occupancy.
- .7 In preparation for interim and final inspections:
 - .1 Examine all sight-exposed interior and exterior surfaced and concealed spaces.
 - .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces, including glass and other polished surfaces.
- .8 Use cleaning materials and methods in accordance with instructions of the manufacturer of the surface to be cleaned.

1.32 DUST CONTROL

- .1 Provide temporary dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work and public.
- .2 Prevent fugitive dust from the Site from interfering with onsite and offsite uses.

1.33 PUBLIC WAY CONSTRUCTION

- .1 Design, erect and maintain hoarding and covered pedestrian walkways to support all loads including windloads and provide protection, complete with signs and electrical lighting as required by authority having jurisdiction.

1.34 ENVIRONMENTAL PROTECTION

- .1 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary enclosures during work.
- .2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.
- .3 Ensure proper disposal procedures in accordance with all applicable territorial regulations.

1.35 MAINTENACE MATERIALS, SPECIAL TOOLS AND SPARE PARTS

- .1 Specific requirements for maintenance materials, tools and spare parts are specified in individual sections of Divisions 02 to 49.

1.36 ADDITIONAL DRAWINGS

- .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the Contract documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of 10 sets of Contract documents for use by the Contractor at no additional cost. Should more than 10 sets of documents be required the Departmental Representative will provide them at additional cost.

1.37 SMOKING ENVIRONMENT

- .1 Smoking within the building is not permitted.
- .2 Smoking on the Site is not permitted.

1.38 SYSTEM OF MEASUREMENT

- .1 The metric system of measurement (SI) will be employed on this Contract.

1.39 FAMILIARIZATION WITH SITE

- .1 Before submitting tender, visit site - as indicated in tender documents and become familiar with all conditions likely to affect the cost of the work.
- .2 No claims or change orders will be considered by PWGSC in regard to existing conditions due to the Contractor's lack of familiarity with the Site.

1.40 SUBMISSION OF TENDER

- .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

1.41 WORK CONSTRAINTS

- .1 It is absolutely crucial that the work does not impact on the normal day to day operation of the Port of Entry site.
- .2 Existing services cannot be interrupted except for short periods of time and only when scheduled in advance. Interruption of any service including power, water, heat, communications, fire alarm, sanitary, gate control, YTG/CBSA radio, site lighting must be coordinated with, and approved by, the Departmental Representative.
- .3 House #9 will not be in use and can be scheduled for demolition at any time.
- .4 Contaminated soils remediation must be complete including backfill and compaction before weather prevents proper compaction.
- .5 The site is very constrained. There is limited space for crew accommodations, parking, laydown, and/or equipment parking/storage on site.
- .6 The Haines Highway is a busy highway during the summer months and construction must not interfere with border crossing operation.

1.42 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Utility Locations: at least 5 Working Days prior to commencing any subsurface disturbance, Submit drawings identifying all utilities on the Site. Update drawings as instructed by the Departmental Representative.
- .2 Breakdown of Lump Sum Prices: at least 5 Working Days prior to submitting the first Progress Payment, Submit a breakdown of the Contract lump sum prices including labour, material and time, in detail as instructed by the Departmental Representative and aggregating Contract Amount.
- .3 Daily Work Records: at the end of each shift Submit daily Work records, during onsite Work. Include:
 - .1 Quantities for each Description of Work identified in the Unit Price Table and Change Orders.
 - .2 Description of Work performed.
 - .3 Current Site conditions.
 - .4 General information including: date, time shift started and ended, Subcontractor(s) onsite, Health and Safety items, and Environmental Protection items.
 - .5 Signature of Superintendent and Departmental Representative.
- .4 Coordination Meeting Minutes and Drawings: at least 5 Working Days prior to

relevant Work commencing, Submit final meeting minutes and drawings from coordination with Subcontractors.

- .5 Quality Management Plan: within 10 Working Days after Contract award, Submit a quality management plan. Include:
 - .1 Details on planned review, inspection and testing to provide Quality Assurance and Quality Control for the Work.
 - .2 Subcontractors responsible for review, inspection and testing.
 - .3 Schedule of submittals of review, inspection and testing results.
- .6 Review, Inspection, and Testing Results: within 5 Working Days of receipt, submit all results of reviews, inspection, and testing performed as part of the Work, including laboratory reports.

1.43 DEPARTMENTAL REPRESENTATIVE FURNISHED ITEMS

- .1 Departmental Representative Responsibilities:
 - .1 Shop drawings and Bill of Materials are included in the Appendices. .
 - .2 Inspect deliveries jointly with Contractor.
- .2 Contractor Responsibilities:
 - .1 Review shop drawings, product data and other submittals. Submit to Departmental Representative notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
 - .2 Deliver and unload products at site.
 - .3 Inspect deliveries jointly with Departmental Representative; record shortages, and damaged or defective items.
 - .4 Handle products at site, including uncrating and storage.
 - .5 Protect products from damage, and from exposure to elements.
 - .6 Assemble, install, connect, adjust, and finish products.
 - .7 Provide installation inspections required by public authorities.
 - .8 Repair or replace items damaged by Contractor or subcontractor on site (under his control).
- .3 Schedule of Departmental Representative furnished items:
 - .1 21,000 litre above grade fuel oil tank and various appertenances.
 - .2 The items are currently located at 419 Range Road in Whitehorse, Yukon.

Part 2 Product

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 CASH ALLOWANCES

- .1 Include in Contract Price specified cash allowances.
- .2 Cash allowances, unless otherwise specified, cover net cost to subcontractor of utility company service incurred in performing Work.installation
- .3 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
- .4 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.
- .5 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.
- .6 Include progress payments on accounts of work authorized under cash allowances in Departmental Representative monthly certificate for payment.
- .7 Amount of each allowance, for Work specified in respective specification Sections is as follows:
 - .1 Include allowance of \$ 5,000 for installation services by NWTel and IPEC .

Part 2 Product

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 Description of Work

- .1 This section covers measurement and payment procedures for all materials, labour, equipment and services necessary for carrying out the Work – Tender A, Site Services and Site Services Building, Pleasant Camp Port of Entry.
- .2 Work included
 - .1 Payment shall be for, but not necessarily limited to the following works:
 - .1 Mobilization.
 - .2 Supply of all materials, plant, equipment, labour, services and supervision to construct Site Services and Site Services Building.
 - .3 Supply of all materials, plant, equipment, labour, supervision, and services for Soil Remediation.
- .3 Incidental Work
 - .1 Measurement and payment shall be in accordance with the Schedule of Lump Sum and Unit Prices. Costs of items of work not listed on the Schedule, considered to be incidental to the Works, shall be included in the appropriate items listed in the schedule.

Part 2 MEASUREMENT AND PAYMENT

2.1 General

- .1 Payment for Work shall be made at the Unit and Lump Sum Prices for the Items appearing in the Schedule for Lump Sums and Unit Prices.
- .2 Any work called for which is not listed as an item in the Schedule of Lump Sum and Unit Prices shall not be paid separately. The cost of such work shall be included in the Unit Prices and Lump Sum Prices. No element shall be included in more than one pay item.
- .3 Progress payments shall be made based on the quantities completed in the field as agreed by the Departmental Representative and the Contractor, and the following clauses.

2.2 Mobilization

- .1 Payment for mobilization shall be made at two Lump Sum Prices as follows:
 - .1 Mobilization – Site Services and Site Services Building.
 - .2 Mobilization - Soil Remediation Work
- .2 Payment shall be for all costs which are independent of the quantities of work done and which are not paid for under other items, and include but not necessarily be limited to mobilization and demobilization, profit and overhead, supervision, fees, permits, services and other items incidental to or for the execution of the general requirements of the Work. Payment for mobilization shall include for demobilization and remobilization following any shutdowns.

- .3 Payment for Mobilization – Site Services and Site Services Building. Payment of 37.5% of the Lump Sum shall be authorized when the Contractor has provided a Construction Schedule and work on site has commenced. Payment of 50.0% of the Lump Sum shall be made as a series of monthly payments, calculated on the basis of the expected schedule. If the Work falls behind or gets ahead of schedule, these payments will be adjusted accordingly. Payment of the remaining 12.5 % shall be authorized when the Work is completed and the site is cleaned up to the satisfaction of the Departmental Representative.
- .4 Payment for Mobilization – Soil Remediation Work. Payment of 37.5% of the Lump Sum shall be authorized at the same time the first payment for Mobilization – Site Services and Site Services Building is authorized. Payment of 50.0% of the Lump Sum shall be authorized upon mobilization of equipment and plant onto site for Soil Remediation Work. Payment of the remaining 12.5 % shall be authorized when the Work is completed and the site is cleaned up to the satisfaction of the Departmental Representative.
- .5 Payment of only 5.0% of the total tender price shall be scheduled as outlined above. If the amount bid for mobilization and demobilization is greater than 5.0 %, payment of the remainder amount shall be authorized when the site is cleaned up.

2.3 Soil Remediation

- .1 Measurement and payment procedures for the following soil remediation items are as per described in section 02 26 00.02:
 - .1 Dewatering Equipment Provision.
 - .2 Dewatering Equipment Operation.
 - .3 Standby Time
 - .4 Site Preparation
 - .5 Site Closure.

2.4 Excavation, Trenching and Backfilling

- .1 Measurement and payment procedures for the following Excavation, Trenching, and Backfilling items are as per described in Section 31 23 33.01
 - .1 Testpitting.
 - .2 Excavation and Stockpiling.
 - .3 Supply, Backfilling and Compaction (Imported Material) – Type 1
 - .4 Supply, Backfilling and Compaction (Imported Material) – Type 2
 - .5 Backfilling and Compaction (Re-Use Compliant Overburden – Type 3).
 - .6 Restoration.
 - .7 Transport and Disposal of Hydrocarbon Contaminated.
 - .8 Non-Contaminated Waste Disposal.

2.5 Other Soil Remediation Related items

- .1 Payment for any other work incidental to Soil Remediation including, but not necessarily limited to, Hydraulic Seeding, Ground Penetrating Radar for Utility Locates and Site Fencing and Special Procedures for Contaminated Sites, if not already included with Mobilization, shall be paid as Lump Sum Price.

2.6 Cash Allowance

- .1 Payment for Cash Allowance shall be as per Section 01 21 00.

2.7 All other work.

- .1 Any and all work called for but not listed or included above as individual unit price or lump sum price items are to be paid as a Lump Sum Price.

2.8 Optional Items

- .1 Optional items as described in Section 31 23 33.01 are for reference only and shall not be used in determining the Total Bid Amount. The Departmental Representative has sole authority to exercise these options or to re-negotiate with the Contractor the quantities and unit prices.

END OF SECTION

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 four days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants Departmental Representative.
- .8 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 5 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 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 00 - Construction Progress Documentation.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Owner provided products.
 - .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work and four (4) weeks prior to project completion, schedule progress meetings as follows:
 - .1 Site Service Building and Site Services: Monthly on site; teleconference every two weeks.
 - .2 Remediation: bi-weekly (twice per work week)
- .2 Contractor, Superintendent, major Subcontractors involved in Work, Departmental Representative, CBSA representative, are to be in attendance.
- .3 Notify parties minimum five (5) days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within five (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.

1.4 TAILGATE MEETINGS

- .1 During the course of the work daily tailgate meetings at the start of each work shift. Multiple meetings will be required if the Contractor intends to work multiple shifts within a 24-hour period.
- .2 All construction workers to attend, including Contractor, Superintendent, major Subcontractors, and environmental consultants. Departmental Representative may attend.
- .3 Agenda to include:
 - .1 Planned Work activities and environmental considerations for that shift.
 - .2 Coordination activities required between Contractor, Subcontractors, Departmental Representative, and other contractors including environmental consultant.
 - .3 Health and Safety items as identified or otherwise required.

1.5 FINAL SITE INSPECTION

- .1 This clause is specific to the site remediation work.
- .2 Within 5 Working Days of completion of Site Works and Demobilization, request a meeting on Site to review the Site.
- .3 Departmental Representative, Contractor, Superintendent, major Subcontractor(s), field inspectors and supervisors to be in attendance.
- .4 Establish time and location of meeting subject to approval by Departmental Representative and notify parties concerned at least 3 Working Days before meeting.
- .5 Agenda to include:
 - .1 Inspect removal of all temporary equipment, materials, supplies, and facilities.
 - .2 Inspect final surface grades.
 - .3 Inspect final vegetation.
 - .4 Inspect permanent facilities for performance and damage.
 - .5 Document all damage, deficiencies, missing items, and non-conformance.
- .6 If required, and in the opinion of the Departmental Representative, perform another Final Site Inspection after resolving all documented damage, deficiencies, missing items, and non-conformance.

Part 2 Product

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 SECTION INCLUDES

- .1 Schedules, form, content, submission.
- .2 Critical path scheduling.
- .3 Progress photographs.
- .4 Submittals schedule.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SCHEDULES

- .1 Submit schedules as follows:
 - .1 Submittal Schedule for Shop Drawings and Product Data.
 - .2 Submittal Schedule for Samples.
 - .3 Product Delivery Schedule.
 - .4 Shutdown or closure activity.
- .2 Schedule Format.
 - .1 Prepare schedule in form of a horizontal Gantt bar chart.
 - .2 Provide a separate bar for each major item of work.
 - .3 Split horizontally for projected and actual performance.
 - .4 Provide horizontal time scale identifying first Working Day of each week.
 - .5 Format for listings: Table of Contents of the Project Manual.
 - .6 Identification of listings: By specification Section numbers.
- .3 Schedule Submission.
 - .1 Submit initial format of schedules within fifteen (15) days after award of Contract.
 - .2 Submit schedules in electronic format, forward as *.pdf files.
 - .3 Consultant will review schedule and return review copy within ten (10) days after receipt.
 - .4 Resubmit finalized schedule within seven (7) days after return of review copy.
 - .5 Submit revised progress schedule with each application for payment.
 - .6 Distribute copies of revised schedule to:
 - .1 Job site office.
 - .2 Subcontractors.
 - .3 Other concerned parties.
 - .7 Instruct recipients to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.

1.4 PROGRESS PHOTOGRAPHS

- .1 Digital Photography:
 - .1 Submit electronic and hard copy of colour digital photography in *.jpg

format, minimum 4 megapixel resolution.

- .2 Identification: Name and number of project and date of exposure indicated.
- .2 Number of Viewpoints: Two (2). Locations of viewpoints determined by Consultant.
- .3 Frequency: Monthly with progress statement.
- .4 Frequency: Every day during excavation.

1.5 SUBMITTALS SCHEDULE

- .1 Include schedule for submitting shop drawings, product data, samples .
- .2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section Section 01 11 55 - General Requirements.

1.2 MEASUREMENT PROCEDURES

- .1 Not used.

1.3 DEFINITIONS

- .1 See 01 11 00 Summary of Work.

1.4 GENERAL

- .1 This Section specifies general requirements and procedures for the Contractor's submissions of shop drawings, product data, samples and other requested submittals to Departmental Representative for review. Additional specific requirements for submissions are specified in individual technical sections.
- .2 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .3 Where items or information is not produced in SI Metric units, converted values are acceptable.
- .4 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 for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by Departmental Representative's review of submission unless Departmental Representative gives written acceptance of specific deviations.
- .8 Make any changes in submissions which Departmental Representative may require consistent with Contract documents and resubmit as directed by Departmental Representative.
- .9 Do not proceed with Work affected by submittal until review is complete.
- .10 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.
- .11 Verify field measurements and affected adjacent Work are co-ordinated.
- .12 Adjustments made on submittals by Departmental Representative are not intended to change Contract price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work
- .13 Keep one reviewed copy of each submission on site.

1.5 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 British Columbia.
- .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 ten (10) days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. 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.

1.6 DOCUMENT SUBMISSION PROCEDURES

- .1 Coordinate each submission with the requirements of the Work and the Contract Documents. Individual submissions will not be reviewed until:
 - .1 Submissions are complete.
 - .2 All related information is available.
- .2 Documents specified to be submitted to the Departmental Representative shall be transmitted through OPROMA, a web-based cloud storage system.
- .3 The Departmental Representative shall give folder access rights to the Contractor's authorized representatives on an as need basis. Submit to the Departmental Representative a list of names with their email addresses requiring such access.
- .4 Upload all submissions into electronic folder or folders as designated by the Departmental Representative. Notify the Departmental Representative of each upload.
- .5 Each submission together with its covering letter shall be contained in one pdf file unless otherwise directed.
- .6 Each file shall be named in accordance with format as directed by the Departmental Representative.
- .7 Files will reside in OPROMA for the duration of the project. Maintain files in assigned folders in an orderly fashion as directed by the Departmental Representative.
- .8 The Departmental Representative will post reviewed submissions on OPROMA for download and distribution.
- .9 When directed by the Departmental Representative, submit hard copies of drawings and documents whose original sheet size exceeds 280x432mm or the number of pages exceeds 100, in addition to transmitting through OPROMA.
- .10 Refer to other sections of these Specifications for further requirements of submissions.

1.7 SHOP DRAWINGS

- .1 Shop drawings: original drawings or modified standard drawings provided by Contractor to illustrate details of portion of work which are specific to project requirements.
- .2 Maximum sheet size: 850 x 1050 mm.
- .3 Cross-reference shop drawing information to applicable portions of the Contract documents.
- .4 Delete information not applicable to project.
- .5 Supplement standard information to provide details applicable to project.

1.8 SHOP DRAWING REVIEW

- .1 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
- .2 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.

- .3 This review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and Contract documents.
- .4 Without restricting generality of foregoing, Contractor is responsible for:
 - .1 Dimensions to be confirmed and correlated at job site,
 - .2 Information that pertains solely to fabrication processes or to techniques of construction and installation, and
 - .3 Co-ordination of the Work of all sub-trades.

1.9 APPROVALS

- .1 Approval of shop drawings and samples required by Departmental Representative as indicated.

1.10 PRODUCT DATA

- .1 Product data: manufacturers' catalogue sheets, MSDS sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products or any other specified information.
- .2 Delete information not applicable to project.
- .3 Supplement standard information to provide details applicable to project.
- .4 Cross-reference product data information to applicable portions of Contract documents.

1.11 SAMPLES

- .1 Samples: examples of materials, equipment, quality, finishes and workmanship.
- .2 Where colour, pattern or texture is criterion, submit full range of samples.
- .3 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.
- .4 For all imported material to be used for backfill, collect samples and send them for analysis at an accredited laboratory prior to material arriving onsite.
 - .1 Collect samples in clean 125mL glass soil sample jars.
 - .2 Request testing for the following parameters:
 - .1 Sieve analytical results for grain-size distribution.
 - .2 Chemical analysis, including: CCME BTEX/F1, CCME hydrocarbons F2-F4; extractable petroleum hydrocarbons; polycyclic aromatic hydrocarbons (PAHs); total metals, and tests suitable for confirming Acid Rock Drainage and Metals Leaching potential.
- .5 For all imported material to be used for road construction, collect sufficient material and request testing of aggregate required by the BC MoTI Standard Specifications for Highway Construction (Section 201 and 202), or Yukon Department of Highways and Public Works requirements.
- .6 Provide the results of analysis to the Departmental Representative and import material only with approval from the Departmental Representative.
- .7 Departmental Representative will inspect imported material, and will not allow import of material that varies from provided samples.

1.12 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic and hard copy of colour digital photography in jpg format, fine resolution monthly with progress statement.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 4 locations.
 - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly.
 - .1 Upon completion of: of Work,.

1.13 PROGRESS SCHDEULE

- .1 Submit work schedule and cost breakdown as required in Section 011155.

1.14 TEST RESULTS AND INSPECTION REPORTS

- .1 Submit in duplicate test results and inspection reports required by Contract specifications.

Part 2 Product

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 SCOPE

- .1 The work involves working immediately adjacent to or within the Haines Highway (Hwy No. 3) at the Port of Entry border crossing site. There is abundant north-bound and south-bound traffic throughout the year that peaks during the summer tourist months.
- .2 The Contractor shall limit activities that impede traffic flow.

1.2 REFERENCES

- .1 British Columbia Ministry of Transportation
 - .1 Traffic Control Manual for Work on Roadways - 99.

1.3 PROTECTION OF PUBLIC TRAFFIC

- .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 Comply with current version of BC Ministry of Transportation and Infrastructure Traffic Control Manual for Work on Roadways, or Yukon Department of Highways and Public Works requirements.
- .3 When working on travelled way:
 - .1 Place equipment in position to minimize interference and hazard to travelling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .4 Close lanes of road only after receipt of written approval from Departmental Representative.
 - .1 Extended closure will require approval from CBSA. Allow sufficient time for approval.
 - .2 Before re-routing traffic erect suitable signs and devices to Traffic Accommodation in Work Zones.
- .5 Keep travelled way graded, free from pot holes and of sufficient width for required number of lanes of traffic.
- .6 Permit from Yukon Dept of Highways and Public Works will be required for work on Haines Highway.
- .7 Provide and maintain road access and egress to property fronting Site and in other areas in accordance with the Contract, except where other means of road access exist that are accepted.

1.4 CONTROL OF PUBLIC TRAFFIC

- .1 Provide competent flag personnel, trained in accordance with, and properly equipped to, current version of BC Ministry of Transportation and Infrastructure Traffic Control Manual for Work on Roadways, or Yukon Department of Highways and Public Works requirements for situations as follows:
 - .1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.

- .2 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

1.5 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices to comply with current version of BC Ministry of Transportation and Infrastructure Traffic Control Manual for Work on Roadways or Yukon Department of Highways and Public Works requirements..
- .3 Place signs and other devices in locations recommended in Work Area Traffic Control Manual.
- .4 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.
- .5 Continually maintain traffic control devices in use:
 - .1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Remove or cover signs which do not apply to conditions existing from day to day.

1.6 OPERATIONAL REQUIREMENTS

- .1 Maintain existing conditions for traffic throughout period of Contract except that, when required for construction in accordance with the Contract and when measures have been taken in accordance with the Contract and accepted by Departmental Representative to protect and control public traffic.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 List of Signs and Devices: within 10 Working Days after Contract award and prior to mobilization to Site, submit a list of signs and other devices required for the project.

Part 2 Product

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1. PART 1 - GENERAL

1.1. Action and Informational Submittals

- 1.1.1. Contaminated Waste Management Plan: within 5 working days after Contract award and prior to mobilization to Site submit plan detailing management of Contaminated Waste.
- 1.1.2. Submittals for Progress Meetings: make submittals at least 24 hours prior to scheduled progress meetings as follows:
 - 1.1.2.1. 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.
 - 1.1.2.2. Copies of transport manifests, trip tickets, and disposal receipts for waste materials removed from work area.
 - 1.1.2.3. Other information required by Departmental Representative or relevant to agenda for upcoming progress meeting.
- 1.1.3. Site Layout: within 5 working days after 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:
 - 1.1.3.1. Equipment and personnel decontamination areas.
 - 1.1.3.2. Means of ingress, egress and temporary traffic control facilities.
 - 1.1.3.3. Equipment and material staging areas.
 - 1.1.3.4. Soil stockpile areas.
 - 1.1.3.5. Water storage tanks and Contaminated Wastewater Treatment Plant, if applicable.
 - 1.1.3.6. Other required features as specified in Contractor's site-specific Health and Safety Plan.
 - 1.1.3.7. Grading, including contours, required to construct temporary facilities.
- 1.1.4. Equipment Decontamination Procedures: Submit equipment decontamination procedures and the proposed area for decontamination in the site layout within 5 days of contract award to Departmental Representative for review prior to commencing the work. Equipment decontamination procedures are to be consistent with industry practices with the level of contamination as identified in the drawings.
- 1.1.5. Transport Manifests: within 5 working days of offsite transport, submit documentation verifying that material has been transported appropriately, including:
 - 1.1.5.1. Method of transport.
 - 1.1.5.2. Name of transport company.
 - 1.1.5.3. Location, date, and quantity of pick-up.
 - 1.1.5.4. Location, date, and quantity of drop-off.
- 1.1.6. Certificate of Disposal: within 30 working days of disposal at offsite Disposal Facility, submit documentation verifying that materials have been disposed by Contractor, including:
 - 1.1.6.1. Issued by the Disposal Facility.
 - 1.1.6.2. On company letterhead.
 - 1.1.6.3. Name and location of facility where the material is being disposed.
 - 1.1.6.4. Date and quantity for each shipment received and total quantity received.
 - 1.1.6.5. Signed by identified authorized company representative.
- 1.1.7. Certificate of Treatment: within 30 working days of treatment at offsite Disposal Facility, submit documentation verifying that materials have been treated by Contractor, including:
 - 1.1.7.1. Issued by the Treatment Facility.
 - 1.1.7.2. On company letterhead.
 - 1.1.7.3. Name and location of facility where the material is being treated.
 - 1.1.7.4. Date and quantity for each shipment received and total quantity received.
 - 1.1.7.5. Date and quantity for each treatment event and total quantity treated.
 - 1.1.7.6. Treatment methodology.
 - 1.1.7.7. Laboratory certificates demonstrating treatment objectives were met.
 - 1.1.7.8. Disposition of treated material.

1.1.7.9. Signed by identified authorized company representative.

1.2. Sequencing and Scheduling

- 1.2.1. Do not commence Work involving contact with potentially Contaminated Waste soil until decontamination facilities are operational and reviewed for acceptance by Departmental Representative.
- 1.2.2. Commence remedial excavation of Area 1 followed by Area 2. Area 3 or Area 4 will commence only at the direction of the Departmental Representative.

1.3. Equipment Decontamination

- 1.3.1. Prior to commencing Work involving equipment contact with potentially Contaminated Wastes, develop an equipment decontamination area to accommodate largest piece of onsite potentially contaminated equipment. Commence Work involving equipment contact with potentially Contaminated Waste only after Equipment Decontamination Area is operational.
- 1.3.2. Provide, operate, and maintain necessary equipment required to collect and contain equipment decontamination waste and transfer materials to accepted storage facilities.
- 1.3.3. Decontaminate equipment after working in potentially contaminated work areas and prior to subsequent Work or travel on clean areas.
- 1.3.4. Perform equipment decontamination as per decontamination procedures required in submittals.
- 1.3.5. 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.
- 1.3.6. 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 at no additional cost.
- 1.3.7. Transfer sediments to soil staging area.
- 1.3.8. Furnish and equip personnel engaged in equipment decontamination with protective equipment as required in the Contractor's Health and Safety Plan.

1.4. Onsite Contaminated Wastewater Treatment Plant

- 1.4.1. Required only if the Contractor chooses not to remove Contaminated Wastewater to an offsite Treatment Facility.
- 1.4.2. Design Requirements:
 - 1.4.2.1. Design and Operating Criteria: design onsite Contaminated Wastewater Treatment Plant capable of treating Contaminated Wastewater generated from dewatering excavations and Work areas to meet Discharge Approval requirements, capable of removing oil, suspended solids, particulates, and asbestos fibers, and filter water through 5-micron particulate filter prior to discharge.
 - 1.4.2.2. Ensure that discharges from Site are in compliance with applicable permit or regulatory requirements and limitations and with Waterway Impact Requirements.
 - 1.4.2.3. Design piping to transfer liquid/solid mixtures generated by dewatering operations which require treatment to onsite Contaminated Wastewater Treatment Plant.
 - 1.4.2.4. Design onsite Contaminated Wastewater Treatment Plant capable of receiving liquid/solid mixtures and not causing delay to dewatering operations.
 - 1.4.2.5. Design onsite Contaminated Wastewater Treatment Plant to meet capacity required by Works.
 - 1.4.2.6. Piping: suitable material type, of sufficient diameter and structural thickness for purpose intended; satisfactorily tested for leaks with potable water in presence of Departmental Representative before handling Contaminated Wastewater.
- 1.4.3. Installation:

- 1.4.3.1. Prepare Site for onsite Contaminated Wastewater Treatment Plant.
- 1.4.3.2. Install component systems in accordance with installation procedures and as required.
- 1.4.3.3. Following installation of system, implement initial operation test in accordance with procedures developed by Contractor and submit results as instructed by the Departmental Representative.
- 1.4.3.4. Install piping in accordance with manufacturer's instructions and test for leakage using potable water prior to commencing dewatering and treatment operations.
- 1.4.4. Initial Testing: determine performance of onsite Contaminated Wastewater Treatment Plant provided by Contractor as follows prior to commencing excavation:
 - 1.4.4.1. Test run with potable water to ensure it is operating currently and no leaks are occurring.
 - 1.4.4.2. Performance verification (contaminant removal) of onsite Contaminated Wastewater treated, stored, tested, assessed, and accepted by Departmental Representative prior to discharge.
 - 1.4.4.3. Provide access for independent collection of treated stored water samples by the Departmental Representative.
- 1.4.5. Operational Testing:
 - 1.4.5.1. Operate onsite Contaminated Wastewater Treatment Plant using experienced, qualified personnel and in accordance with manufacturer's instructions and procedures as Submittals by Contractor.
 - 1.4.5.2. Collect, analyze, and assess samples as recommended by a Qualified Professional.
 - 1.4.5.3. Provide access for independent collection of samples by the Departmental Representative.
 - 1.4.5.4. On basis of analytical results by Contractor or Departmental Representative obtained from samples collected at the discharge point, make system modifications required for effluent to satisfy effluent criteria, or continue with normal dewatering operations as instructed by the Departmental Representative.
- 1.4.6. Decommissioning/Dismantling:
 - 1.4.6.1. Decontaminate and remove salvageable components of onsite Contaminated Wastewater Treatment Plant including treatment system, pumps, piping, and electrical equipment.
 - 1.4.6.2. Dispose of non-salvageable equipment and materials at Disposal Facility accepted by the Departmental Representative. Decontaminate salvageable equipment as required prior to demobilization from Site.

1.5. Offsite Contaminated Wastewater Treatment Plant

- 1.5.1. Offsite Contaminated Wastewater Treatment Plant requirements:
 - 1.5.1.1. Be an existing offsite facility located in Canada. The Disposal Facility must have an authorization issued by a province or territory.
 - 1.5.1.2. Be designed, constructed and operated for the handling or processing of Contaminated Wastewater in such a manner as to change the physical, chemical or biological character or composition of the water to lower than the site-specific remedial objective, Discharge Approval, and in compliance with all regulations.
 - 1.5.1.3. Hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the treatment of Contaminated Wastewater.
 - 1.5.1.4. Comply with applicable municipal zoning, bylaws, and requirements.
- 1.5.2. Subsequently dispose treated material after confirmation of treatment in manner not injurious to public health or safety, to property.
- 1.5.3. If proposed Treatment Facility is not acceptable to Departmental Representative, identify an alternate Treatment Facility that is acceptable.
- 1.5.4. Submit Certificates of Treatment for all material treated offsite.

1.6. Soil Stockpiling Facilities

- 1.6.1. Provide, maintain, and operate storage/stockpiling facilities as required. Obtain approval of proposed storage/stockpiling facilities areas from Departmental Representative. Soil stockpiles

to be located within a reasonable distance of the excavation area and within the site boundary in an area to be approved by the Departmental Representative.

- 1.6.2. Segregate non-contaminated soil from contaminated soil.
- 1.6.3. Store non-contaminated soil excavated only on non-contaminated site surface areas. Ensure no contact between non-contaminated excavated soil and drainage or contaminated water or contaminated soil.
- 1.6.4. Store excavated, contaminated soil in water-tight temporary storage cells.
 - 1.6.4.1. Install impermeable liner below proposed stockpile locations to prevent contact between stockpile material and ground.
 - 1.6.4.2. Cover stockpiled material when not being worked or sampled to prevent release of airborne dust, vapours, or odours, and to prevent saturation and leachate generation of material.
 - 1.6.4.3. Segregate different suspect material in discrete piles as determined by Departmental Representative.
 - 1.6.4.4. Assist Departmental Representative in collection of stockpile samples for ex-situ characterization. Ex-situ characterization may take up to 5 working days. No standby charges or delays to be incurred for sampling.
 - 1.6.4.5. Equip facility with tarps capable of covering stockpiled material until Departmental Representative advises Contractor to dispose of material offsite.

1.7. Disposal Facility

- 1.7.1. Identify the facility(s) that will be used to treat and/or dispose of each of the categories of materials identified. Evidence that they are authorized and/or licensed to accept, treat and dispose of the specific category of material. Disposal Facility requirements:
 - 1.7.1.1. Be an existing offsite facility located in Canada. The Disposal Facility must have an authorization issued by a province or territory.
 - 1.7.1.2. Be designed, constructed and operated to prevent any pollution from being caused by the facility outside the area of the facility from waste placed in or on land within the facility.
 - 1.7.1.3. Hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of soil, wastewater, sediment, general refuse, construction/demolition waste or other material requiring disposal.
 - 1.7.1.4. Comply with applicable municipal zoning, bylaws, and requirements.
 - 1.7.1.5. If proposed Disposal Facility is not acceptable to Departmental Representative, identify an alternate Disposal Facility that is acceptable.

1.8. Vehicular Access and Parking

- 1.8.1. Maintenance and Use:
 - 1.8.1.1. 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 dispose of in appropriate offsite disposal facility. Clean access roads at least once per working day.
 - 1.8.1.2. Departmental Representative may collect soil samples for chemical analyses from traveling 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 or time.

1.9. Dust and Particulate Control

- 1.9.1. Execute Work by methods to minimize raising dust from construction operations.
- 1.9.2. Implement and maintain dust and particulate control measures immediately as determined necessary by Departmental Representative during construction and in accordance with regulations.
- 1.9.3. Provide positive means to prevent airborne dust from dispersing into atmosphere. Use potable water for dust and particulate control.

- 1.9.4. As minimum, use appropriate covers on trucks hauling fine or dusty material. Use watertight vehicles to haul wet materials.
- 1.9.5. Prevent dust from spreading to adjacent property sites.
- 1.9.6. 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.
- 1.9.7. 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 at no additional cost or time.

1.10. Pollution Control

- 1.10.1. 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.
- 1.10.2. 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 onsite.
- 1.10.3. Promptly report spills and releases potentially causing damage to environment to:
 - 1.10.3.1. Authority having jurisdiction or interest in spill or release including conservation authority, water supply authorities, drainage authority, road authority, and fire department.
 - 1.10.3.2. Departmental Representative.
- 1.10.4. Take immediate action using available resources to contain and mitigate effects on environment and persons from spill or release.
- 1.10.5. 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.
- 1.10.6. Volatile Organic Compounds (VOC) Control:
 - 1.10.6.1. In addition to requirements of Health and Safety for Contaminated Sites, monitor air quality for volatile organics at perimeter security locations as approved by Departmental Representative, every hour during contaminated materials excavation and management activities, and maintain log of air quality readings.
 - 1.10.6.2. If air quality monitoring indicates that release of volatile organics in air at site boundary exceeds Level C of Personnel Protective Equipment threshold for air quality, implement corrective actions to control volatile organics.
 - 1.10.6.3. If actions are not sufficient to control release of volatile organics within 1/2 hour of identification of air quality problem, suspend work resulting in excessive volatile organic emissions. Departmental Representative and Contractor to discuss additional methods that Contractor proposes to control release of volatile organics.
 - 1.10.6.4. Make necessary changes at no additional cost to Departmental Representative prior to resuming Work.

1.11. Water Control

- 1.11.1. When working above the water table or as directed by the Departmental Representative maintain excavations free of water.
- 1.11.2. Protect Site from puddling or running water. Grade Site to drain. Provide water barriers as necessary to protect Site from soil erosion.
- 1.11.3. Prevent surface water runoff from leaving work areas.

- 1.11.4. Do not discharge decontaminated water, or surface water runoff, or groundwater which may have come in contact with potentially Contaminated Waste, offsite or to municipal sewers.
- 1.11.5. Prevent precipitation from infiltrating or from directly running off stockpiled materials. Cover stockpiled materials with an impermeable liner during periods of Work stoppage including at end of each working day and as determined by Departmental Representative.
- 1.11.6. Direct surface waters that have not contacted potentially Contaminated Wastes to surface drainage systems.
- 1.11.7. Control surface drainage including ensuring that gutters are kept open, water is not allowed across or over pavements or sidewalks except through accepted pipes or properly constructed troughs, and runoff from unstabilized areas is intercepted and diverted to suitable outlet.
- 1.11.8. Dispose of water in manner not injurious to public health or safety, to property, or to any part of Work completed or under construction.
- 1.11.9. Provide, operate, and maintain necessary equipment appropriately sized to keep above water table excavations, staging pads, and other work areas free from water.

1.12. Erosion and Sediment Control

- 1.12.1. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas. Prevent erosion and sedimentation.
- 1.12.2. Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical. Strip vegetation, regrade, or otherwise develop to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and water courses, and repair damage caused by soil erosion and sedimentation as determined by Departmental Representative.
- 1.12.3. Provide and maintain temporary measures which may include, silt fences, hay or straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, sedimentation basins, vegetative cover, dikes, and other construction required to prevent erosion and migration of silt, mud, sediment, and other debris offsite 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. Place silt fences and/or hay or straw bales in ditches to prevent sediments from escaping from ditch terminations.
- 1.12.4. Hay or Straw Bale: wire bound or string tied; securely anchored by at least 2 stakes or rebars driven through bale 300 mm to 450 mm into ground; chinked (filled by wedging) with hay or straw to prevent water from escaping between bales; and entrenched minimum of 100 mm into ground.
- 1.12.5. Silt Fence: assembled, ready to install unit consisting of geotextile attached to driveable posts. Geotextile: uniform in texture and appearance, having no defects, flaws, or tears that would affect its physical properties; and contain sufficient ultraviolet ray inhibitor and stabilizers to provide minimum 2-year service life from outdoor exposure.
- 1.12.6. Net Backing: industrial polypropylene mesh joined to geotextile at both top and bottom with double stitching of heavy-duty cord, with minimum width of 750 mm.
- 1.12.7. Posts: sharpened wood, approximately 50 mm square, protruding below bottom of geotextile to allow minimum 450 mm embedment; post spacing 2.4 m maximum. Securely fasten each post to geotextile and net backing using suitable staples.
- 1.12.8. Plan construction procedures to avoid damage to Work or equipment encroachment onto water bodies or drainage ditch banks. In event of damage, promptly take action to mitigate effects. Restore affected bank or water body to existing condition.
- 1.12.9. Installation:
 - 1.12.9.1. Construct temporary erosion control items as required.
 - 1.12.9.2. Do not construct bale barriers and silt fence in flowing streams or in swales.
 - 1.12.9.3. Check erosion and sediment control measures weekly after each rainfall; during prolonged rainfall check daily.

- 1.12.9.4. Bales and/or silt fence may be removed at beginning of work day, replace at end of work day.
- 1.12.9.5. Whenever sedimentation is caused by stripping vegetation, regrading, or other development, remove it from adjoining surfaces, drainage systems, and watercourses, and repair damage as quickly as possible.
- 1.12.9.6. Prior to or during construction, Departmental Representative may require installation or construction of improvements to prevent or correct temporary conditions onsite. Improvements may include berms, mulching, sediment traps, detention and retention basins, grading, planting, retaining walls, culverts, pipes, guardrails, temporary roads, and other measures appropriate to specific condition. Temporary improvements must remain in place and in operation as necessary or until otherwise determined by Departmental Representative.
- 1.12.9.7. Repair damaged bales, end runs, and undercutting beneath bales.
- 1.12.9.8. Unless requested by Departmental Representative, remove temporary erosion and sediment control devices upon completion of Work. Spread accumulated sediments to form a suitable surface for seeding or dispose of, and shape area to permit natural drainage to satisfaction of Departmental Representative. Materials once removed become property of Contractor.
- 1.12.10. Construct fill areas by selective placement to avoid erosive surface silts or clays.
- 1.12.11. Do not disturb existing embankments or embankment protection.
- 1.12.12. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- 1.12.13. If soil and debris from Site accumulate in low areas, storm sewers, roadways, gutters, ditches, or other areas where in Departmental Representative's determination it is undesirable, remove accumulation and restore area to original condition.

1.13. Progress Cleaning

- 1.13.1. Maintain cleanliness of Work and surrounding site to comply with federal, provincial, and local fire and safety laws, ordinances, codes, and regulations.
- 1.13.2. Coordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials.

1.14. Final Decontamination

- 1.14.1. Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially Contaminated Wastes prior to removal from Site.
- 1.14.2. Perform decontamination as specified to satisfaction of Departmental Representative. Contractor to perform additional decontamination if required.

1.15. Contaminated Wastewater

- 1.15.1. Assume ownership of, and be responsible for Contaminated Wastewater once it is loaded on a vehicle, barge, or other vessel for transport offsite or once it enters the Contaminated Wastewater Treatment Plant.
- 1.15.2. Collect Contaminated Wastewater that has, or potentially has, come into contact with Contaminated Waste including excavation and stockpile areas, or is otherwise potentially contaminated from Work activities.
- 1.15.3. Transport and treat collected Contaminated Wastewater at Contaminated Wastewater Treatment Plant.
- 1.15.4. Discharge to environment: obtain Discharge Approval from authority having jurisdiction. Comply with Waterway Impact Requirements.

1.16. Contaminated Waste Transport

- 1.16.1. Assume ownership of, and be responsible for, Contaminated Waste once it is loaded on a vehicle, barge, or other vessel for transport offsite.
- 1.16.2. Transport material offsite as soon as practical. Do not unreasonably stockpile material onsite.
- 1.16.3. Cover material while being transported to prevent release of airborne dust, vapours, or odours, and to prevent saturation and leachate generation from material.
- 1.16.4. Do not allow excess water in soil or sediment to flow out of vehicle or vessel during transport.
- 1.16.5. Stabilize soil, sediment or other material as necessary.
- 1.16.6. Transport Hazardous Waste soil or other material by appropriately licensed and equipped vehicles, vessels and operators.
- 1.16.7. Independent Marine Surveyor to inspect all barges and submit a copy of the Certificate of Seaworthiness to Departmental Representative.
- 1.16.8. Manifest and correlate weights of all material transported from Site documenting weight at removal from Site, movement, transfer stations, interim storage and treatment, and weight of material at final Disposal Facility. Submit all manifests, as instructed by the Departmental Representative.
- 1.16.9. Resolve discrepancies in manifests for material transported as required by regulations and as acceptable to the Departmental Representative. Discrepancies include:
 - 1.16.9.1. No manifest or an incomplete manifest.
 - 1.16.9.2. The material transported does not match the description in the manifest.
 - 1.16.9.3. The amount transported differs by more than 5% in the manifest.
 - 1.16.9.4. The material transported is in a hazardous condition.

1.17. Contaminated Waste Disposition

- 1.17.1. Treat and dispose of Contaminated Waste as follows, otherwise in accordance with the Contract, or as instructed by the Departmental Representative:
 - 1.17.1.1. Hazardous Waste-treatable: Treat this material at a Treatment Facility prior to disposal at a Disposal Facility.
 - 1.17.1.2. Hazardous Waste-nontreatable: Dispose this material at a Disposal Facility.
 - 1.17.1.3. Hazardous Waste-comingled: Treat this material at a Treatment Facility prior to disposal at a Disposal Facility.
 - 1.17.1.4. Waste Quality-treatable: Treat this material at a Treatment Facility prior to disposal at a Disposal Facility.
 - 1.17.1.5. Waste Quality-nontreatable: Dispose this material at a Disposal Facility.
 - 1.17.1.6. Waste Quality-comingled: Treat this material at a Treatment Facility prior to disposal at a Disposal Facility.

1.18. Contaminated Waste Treatment

- 1.18.1. Contaminated Waste Treatment: treat at Treatment Facility identified by Contractor and accepted by the Departmental Representative.
- 1.18.2. Treatment Facility requirements:
 - 1.18.2.1. Be an existing offsite facility located in Canada.
 - 1.18.2.2. Be designed, constructed and operated for the handling or processing of waste in such a manner as to change the physical, chemical or biological character or composition of waste amenable to treatment to lower than the applicable provincial or territorial regulatory standards / guidelines.
 - 1.18.2.3. Hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the treatment of soil or other material that is Waste Quality.
 - 1.18.2.4. Comply with applicable municipal zoning, bylaws, and requirements.
- 1.18.3. Subsequently dispose treated material at a Disposal Facility after confirmation of treatment.
- 1.18.4. Treatment includes bioremediation, thermal desorption, and incineration. Treatment does not include blending, mixing, or dilution.

- 1.18.5. If proposed Treatment Facility is not acceptable to Departmental Representative, identify an alternate Treatment Facility that is acceptable.
- 1.18.6. Submit Certificates of Treatment for all material treated offsite.

1.19. Contaminated Waste Disposal

- 1.19.1. Contaminated Waste Disposal: dispose Contaminated Waste at Disposal Facility identified by Contractor and accepted by the Departmental Representative.
- 1.19.2. Disposal Facility requirements:
 - 1.19.2.1. Be an existing offsite facility located in Canada.
 - 1.19.2.2. Be designed, constructed and operated to prevent any pollution from being caused by the facility outside the area of the facility from waste placed in or on land within the facility.
 - 1.19.2.3. Hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of soil or other material that is Waste Quality.
 - 1.19.2.4. Comply with applicable municipal zoning, bylaws, and requirements.
- 1.19.3. Dispose material as soon as practical and within 10 Working Days of leaving Site unless otherwise accepted by Departmental Representative.
- 1.19.4. Permanently store material sent to a Disposal Facility at that facility.
- 1.19.5. If proposed Disposal Facility is not acceptable to Departmental Representative, identify an alternate Disposal Facility that is acceptable.
- 1.19.6. Submit Certificates of Disposal for all material disposed offsite.

2. PART 2 - PRODUCTS

2.1. Not Used

- 2.1.1. Not Used.

3. PART 3 - EXECUTION

3.1. Not Used

- 3.1.1. Not Used.

END OF SECTION

1. REFERENCES

- .1 Government of Canada:
 - .1 Canada Labour Code – Part II
 - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA): as amended:
 - .1 CSA Z797-2009 Code of Practice for Access Scaffold.
 - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes.
 - .3 CSA-S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .4 Fire Protection Engineering Services, HRSDC:
 - .1 FCC No. 301, Standard for Construction Operations.
 - .2 FCC No. 302, Standard for Welding and Cutting.
- .5 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .6 Province of British Columbia:
 - .1 Workers Compensation Act Part 3 - Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulation.

2. RELATED SECTIONS

- .1 Refer to the following current NMS sections as required:
 - .1 Construction progress Documentation: Section 013200
 - .2 Submittals procedures: Section 013300
 - .3 Health and safety contaminated sites: Section 013529
 - .4 Special procedures – traffic control: Section 013500
 - .5 Temporary utilities: Section 015100
 - .6 Construction facilities: Section 015200
 - .7 Temporary barriers and enclosures: Section 015600
 - .8 Structure demolition: Section 024116
 - .9 Hazardous Materials: Section 028101
 - .10 Asbestos abatement: Section 028210.01
Section 028210.02
Section 028210.03

3. WORKERS' COMPENSATION BOARD COVERAGE

- .1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

- .2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

4. COMPLIANCE WITH REGULATIONS

- .1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations

5. SUBMITTALS

- .1 Submit to Departmental Representative submittals listed for review in accordance with Section 013300.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 Submit the following:
 - .1 Health and Safety Plan.
 - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
 - .3 Copies of incident and accident reports.
 - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .5 Emergency Procedures.
 - .6 Notice of Project
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.
- .5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.
- .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
 - .1 Be construed to imply approval by the Departmental Representative.
 - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
 - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

6. RESPONSIBILITY

- .1 Assume responsibility as the Prime Contractor for Work under this Contract

- .2 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.
- .3 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

7. HEALTH AND SAFETY COORDINATOR

- .1 The Health and Safety Coordinator must:
 - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
 - .2 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.
 - .3 Be on site during execution of work.

8. GENERAL CONDITIONS

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
 - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
 - .2 Secure site at night time or provide security guard as deemed necessary to protect site against entry.
 - .3 Fence excavation areas with temporary fence panels (6' height x 10' width minimum).

9. PROJECT/SITE CONDITIONS

- .1 Work at site may involve contact with:
 - .1 Asbestos and/or Chrysotile,
 - .2 Potential PCB containing ballasts,
 - .3 Non-Chlorofluorocarbons containing appliances (Non-ODS),
 - .4 Mercury containing devices,
 - .5 Mercury vapour containing fluorescent lights and/or high intensity discharge lamps,
 - .6 Silica containing building materials (foundation, floors, walls),
 - .7 Work at Site will involve contact with contaminants identified in Specifications and environmental reports including possible residual hydrocarbon liquids/vapours in the soils and groundwater,
 - .8 Lead Paint,
 - .9 Septic fields

10. REGULATORY REQUIREMENTS

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

11. WORK PERMITS

- .1 Obtain specialty permits related to project before start of work.

12. FILING OF NOTICE

- .1 The General Contractor is to complete and submit a Notice of Project as required by B.C. Occupational Health and Safety Regulation s20.2.
- .2 Provide copies of all notices to the Departmental Representative.

13. HEALTH AND SAFETY PLAN

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary requirements:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.
 - .4 General safety rules for project.
 - .5 Job-specific safe work, procedures.
 - .6 Inspection policy and procedures.
 - .7 Incident reporting and investigation policy and procedures.
 - .8 Occupational Health and Safety Committee/Representative procedures.
 - .9 Occupational Health and Safety meetings.
 - .10 Occupational Health and Safety communications and record keeping procedures.
 - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
 - .3 List hazardous materials to be brought on site as required by work.
 - .4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
 - .5 Identify personal protective equipment (PPE) to be used by workers.
 - .6 Identify personnel and alternates responsible for site safety and health.

- .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

14. EMERGENCY PROCEDURES

- .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
 - .1 Designated personnel from own company.
 - .2 Regulatory agencies applicable to work and as per legislated regulations.
 - .3 Local emergency resources.
 - .4 Departmental Representative.
- .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.
 - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
 - .6 Notify Departmental Representative [site staff].
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
 - .1 Work at high angles.
 - .2 Work in confined spaces or where there is a risk of entrapment.
 - .3 Work with hazardous substances.
 - .4 Underground work.
 - .5 Work on, over, under and adjacent to water.
 - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

15. HAZARDOUS PRODUCTS

- .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 Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 013300.
 - .2 In conjunction with Departmental Representative, schedule to carry out work during “off hours” when tenants have left the building.
 - .3 Provide adequate means of ventilation in accordance with Section 015100.

16. ASBESTOS HAZARD

- .1 Modifications to spray- or trowel-applied asbestos surfaces can be hazardous to health.
- .2 Removal and handling of asbestos will be performed as indicated in Sections 024116 and 028210.01, 028210.02 and 028210.03.

17. PCB REMOVALS

- .1 Mercury-containing fluorescent tubes and ballasts which contain polychlorinated biphenyls (PCBs) are classified as hazardous waste.
- .2 Remove, handle, transport and dispose of as indicated in Section 02 81 01.

18. REMOVAL OF LEAD-CONTAINING PAINTS

- .1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition activities involving lead-containing paints in accordance with applicable Provincial regulations.

19. ELECTRICAL SAFETY REQUIREMENTS

- .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
 - .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.
 - .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

20. ELECTRICAL LOCKOUT

- .1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request / authorization form. Have procedures available for review upon request by the Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

21. OVERLOADING

- .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

22. FIRE SAFETY AND HOT WORK

- .1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

23. FIRE SAFETY REQUIREMENTS

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

24. FIRE PROTECTION AND ALARM SYSTEM

- .1 Fire protection and alarm systems shall not be:
 - .1 Obstructed.
 - .2 Shut off.
 - .3 Left inactive at the end of a working day or shift.
- .2 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

25. UNFORESEEN HAZARDS

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

26. POSTED DOCUMENTS

- .1 Post legible versions of the following documents on site:
 - .1 Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
 - .9 Material Safety Data Sheets (MSDS).

- .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

27. MEETINGS

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.
- .2 Ensure all site personnel attend a health and safety toolbox meeting at the beginning of each shift, which must include:
 - .1 Sign-in of all attendees.
 - .2 Planned Work activities and environmental considerations for that shift.
 - .3 Hazards associated with these Work activities, including environmental hazards (eg potential for hypothermia, heat exhaustion, heat stroke).
 - .4 Appropriate job-specific safe work procedures.
 - .5 Required personal protective equipment (PPE).
 - .6 Appropriate emergency procedures.
 - .7 Review recent accidents on Site, including near misses.
- .3 Retain records of all health and safety meetings onsite during Work, and retain as corporate records for a minimum of 7 years after Work is completed.

28. CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a “stop work order” if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a “stop work order”.
- .4 Correct non-compliance

29. CRITICAL INCIDENT REPORTING

- .1 Critical Incident includes:
 - .1 An event resulting in death or serious injury to employees, client department personnel, contractors or the general public entering or occupying PWGSC facilities. This can include physically or psychologically traumatic events such as natural disasters, hostage takings, terrorism, rape, acts or threats of violence, accidents, suicides or homicides.
 - .2 A fire or explosion causing equipment or property damage or threat to another property.

- .3 Damage to a boiler or other pressure vessel resulting in fire or rupture of equipment.
 - .4 The free fall of or damage to an elevating device rendering it unserviceable.
 - .5 The uncontrolled release or spill of hazardous wastes or materials.
 - .6 The implementation of rescue, revival or other similar emergency procedures.
 - .7 A structural failure or collapse of a building, tower, crane, hoist, temporary construction support system or excavation.
 - .8 An electric shock, toxic or oxygen deficient atmosphere causing an employee to lose consciousness.
- .2 In the event of a Critical Incident, immediate actions include:
- .1 Contacting emergency services as required (ambulance, fire department, police, environment).
 - .2 Initiating urgently required corrective action appropriate to the incident (protect life, first-aid treatment, minimize property damage, etc.).
 - .3 Contacting the Departmental Representative.
 - .4 Ensuring that evidence on the site is not disturbed until investigations have been completed.
 - .5 Cooperating with officials authorized to investigate the incident.

30. UTILITY CLEARANCE

- .1 The Contractor is solely responsible for utility clearance.
- .2 The Contractor will not rely upon Drawings or other information provided with utility locations.

31. PERSONAL PROTECTIVE EQUIPMENT PROGRAM

- .1 Submit Personal Protective Equipment (PPE) program to the Departmental Representative addressing:
 - .1 Donning and doffing procedures.
 - .2 PPE selection based upon Site hazards.
 - .3 PPE use and limitations of equipment.
 - .4 Work mission duration, PPE maintenance and storage.
 - .5 PPE decontamination and disposal.
 - .6 PPE inspection procedures prior to, during, and after use.
 - .7 Evaluation of effectiveness of PPE program, and limitations during temperature extremes, and other appropriate medical considerations.
 - .8 Medical surveillance requirements for personnel assigned to work at Site.
 - .9 Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment.
 - .10 Site control measures employed at Site including site map, site work zones, use of 'buddy system', site communications including site security, alerting means for emergencies, standard operating procedures or safe work practices, and identification of nearest medical assistance.
 - .11 Decontamination procedures for both personnel and equipment.

- .12 Emergency response requirements addressing: pre-emergency planning, personnel roles, lines of authority and communication, emergency recognition and prevention, safe distances and places of refuge, site security and control, evacuation routes and procedures, decontamination procedures not covered under decontamination section, emergency medical treatment and first aid, emergency alerting and response procedures, critique of response and follow-up, PPE and emergency equipment, site topography, layout, prevailing weather conditions, and procedures for reporting incidents to local, provincial, or federal agencies.
- .13 Written respiratory protection program for project activities.
- .14 Procedures dealing with heat and/or cold stress.
- .15 Spill containment program if waste material is generated, excavated, stored, or managed onsite.

32. OFFSITE CONTINGENCY AND EMERGENCY RESPONSE PLAN

- .1 Prior to commencing Work involving handling of hazardous materials, develop offsite Contingency and Emergency Response Plan.
- .2 Plan must provide immediate response to serious site occurrence such as explosion, fire, or migration of significant quantities of toxic or hazardous material from Site.

33. PERSONNEL HEALTH, SAFETY, AND HYGIENE

- .1 Training: ensure personnel entering Site are trained in accordance with specified personnel training requirements. Training session must be completed by Health and Safety Officer.
- .2 Levels of Protection: establish levels of protection for each Work area based on planned activity and location of activity.
- .3 Personal Protective Equipment:
 - .1 Furnish site personnel with appropriate PPE as specified above. Ensure that safety equipment and protective clothing is kept clean and maintained.
- .4 Develop protective equipment usage procedures and ensure that procedures are strictly followed by site personnel; include following procedures as minimum:
 - .1 Ensure prescription eyeglasses worn are safety glasses and do not permit contact lenses onsite within work zones.
 - .2 Ensure footwear is steel-toed safety shoes or boots and is covered by rubber overshoes when entering or working in potentially contaminated work areas.
 - .3 Dispose of or decontaminate PPE worn onsite at end of each workday.
 - .4 Decontaminate reusable PPE before reissuing.
 - .5 Ensure site personnel have passed respirator fit test prior to entering potentially contaminated work areas.
 - .6 Ensure facial hair does not interfere with proper respirator fit.
- .5 Respiratory Protection:
 - .1 Provide site personnel with extensive training in usage and limitations of, and qualitative fit testing for, air purifying and supplied-air respirators in accordance with specified regulations.
 - .2 Develop, implement, and maintain respirator program.

- .3 Monitor, evaluate, and provide respiratory protection for site personnel.
- .4 Ensure levels of protection as listed have been chosen consistent with site-specific potential airborne hazards associated with major contaminants identified onsite.
- .5 In absence of additional air monitoring information or substance identification, retain an industrial hygiene specialist to determine minimum levels of respiratory protection required.
- .6 Immediately notify Departmental Representative when level of respiratory protection required increases.
- .7 Ensure appropriate respiratory protection during Work activities. As minimum requirement, ensure that persons entering potentially contaminated work areas are supplied with and use appropriate respiratory protection.
- .6 Heat Stress/Cold Stress: implement heat stress or cold stress monitoring program as applicable and include in site-specific Health and Safety Plan.
- .7 Personnel Hygiene and Personnel Decontamination Procedures. Provide minimum as follows:
 - .1 Suitable containers for storage and disposal of used disposable PPE.
 - .2 Potable water and suitable sanitation facility.
- .8 Emergency and First-Aid Equipment:
 - .1 Locate and maintain emergency and first-aid equipment in appropriate location onsite including first-aid kit to accommodate number of site personnel; portable emergency eye wash; two 9 kg ABC type dry chemical fire extinguishers.
- .9 Site Communications:
 - .1 Post emergency numbers near site telephones.
 - .2 Ensure personnel use of "buddy" system and develop hand signal system appropriate for site activities.
 - .3 Provide employee alarm system to notify employees of site emergency situations or to stop Work activities if necessary.
 - .4 Furnish selected personnel with 2-way radios.
 - .5 Safety Meetings: conduct mandatory daily safety meetings for personnel, and additionally as required by special or Work-related conditions; include refresher training for existing equipment and protocols, review ongoing safety issues and protocols, and examine new site conditions as encountered. Hold additional safety meetings on as-needed basis.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 – Cleaning.

1.2 REFERENCES

- .1 Reference Standards:
 - .1 Canadian Environmental Protection Act (CEPA)
 - .1 CCME PN 1326-[2008], Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
 - .2 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005-[92], Storm Water Management for Construction Activities, Chapter 3.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Within 5 working days after Contract award and prior to mobilization to Site, submit Environmental Protection Plan for review by Departmental Representative.
- .2 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Prior to commencing construction activities or delivery of materials to site, provide Environmental Protection Plan for review and approval by Departmental Representative.
- .4 Ensure Environmental Protection Plan includes 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 demolition task[s].
- .6 Include in Environmental Protection Plan:
 - .1 Name[s] of person[s] responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Name[s] and qualifications of person[s] responsible for manifesting hazardous waste to be removed from site.
 - .3 Name[s] and qualifications of person[s] responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan 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 laws and regulations.

- .6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site, if necessary.
- .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Ensure plans include measures to minimize amount of mud 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. Ensure plan includes measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .9 Spill Control Plan including 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 management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .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.
- .15 Pesticide treatment plan to be included and updated, as required.

1.4 FIRES

- .1 Fires and burning of rubbish on site not permitted.

1.5 CLEANING

- .1 Maintain cleanliness of Work and surrounding Site to comply with federal, provincial, and municipal fire and safety laws, ordinances, codes, and regulations applicable to the performance of the Work.
- .2 Coordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials.
- .3 Ensure cleanup of the Work areas each day after Final Completion of Work.

1.6 DRAINAGE

- .1 Provide Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls provided. Ensure plan includes monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .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, and must include silt fencing.
 - .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.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.7 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 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 Restrict tree removal to areas indicated or designated by Departmental Representative.
- .6 Restrict tree and plant removal to areas in accordance with the Contract or as instructed by the Departmental Representative. Protect all other trees and plants onsite and offsite.
- .7 Salvage all trees and plants to be removed in accordance with the Contract or as instructed by the Departmental Representative.

1.8 WORK IN OR ADJACENT TO WATERWAYS

- .1 Guidelines and Practices:

- .1 Follow practices described in Fisheries and Oceans Canada (September 1993) *Land Development Guidelines for the Protection of Aquatic Habitat.*
 - .2 Follow practices described in BC Ministry of Environment (March 2004) *Standards and Best Practices for Instream Works.*
 - .3 Comply with Fisheries Act Authorization and other relevant authorizations and in accordance with the Contract.
- .2 General:
- .1 Construction equipment to be operated on land only unless equipment is specifically designed and permitted to operate in water.
 - .2 Do not use waterway beds for borrow material.
 - .3 Waterways to be free of excavated fill, waste material and debris.
 - .4 Design and construct temporary crossings to minimize erosion to waterways.
 - .5 Do not skid logs or construction materials across waterways.
 - .6 Avoid spawning beds when constructing temporary crossings of waterways.
- .3 Machinery:
- .1 Ensure all hydraulic machinery to be used in or adjacent to waterways use environmentally sensitive hydraulic fluids which are non-toxic to aquatic life, and which are readily or inherently bio-degradable.
 - .2 Place oil drip trays or absorbent materials (e.g. pads) under any heavy equipment working within the Fisheries Sensitive Zone adjacent to the watercourse to ensure there is no potential for contamination of the streambanks or watercourse resulting from leaks or drip off machinery. Ensure that there is no potential for oil, grease or other deleterious substances to enter any watercourse, ravine or storm sewer system.
 - .3 All equipment and machinery working within 15 meters of any watercourse to be in good working condition (including power washed) and free of leaks or excess oil and grease. No fuels, lubricants, construction wastes or other deleterious substances can enter any watercourse at any time.
- .4 Watercourse Maintenance:
- .1 Do not disturb streamside or riparian vegetation in accordance with the Contract. Do not disturb important native in-water aquatic vegetation including cattails.
 - .2 Do not disturb the watercourse bank or the root systems of vegetation growing on the watercourse banks in accordance with the Contract.
- .5 Sediment Control and Deleterious Substances:
- .1 Undertake and complete all Work in such a manner to prevent the release of silt, sediment or sediment laden water, raw concrete or concrete leachate, or any other deleterious substances to any ditch, watercourse, ravine or storm sewer system.
 - .2 Dispose of, or place in a manner that prevents their entry into any watercourse, ravine or storm sewer system, construction and excavation wastes, Overburden, soil, sediment, concrete, concrete leachate, grout, oil, grease or any other substance deleterious to aquatic life.
 - .3 Remove all excavated material from the Site or place in a stable area above the high water mark of the watercourse, as far as possible from the channel and

protected from erosion by mitigating measures including temporary covering exposed soil or sediment with: polyethylene covers, geotextile fabric, hydro-seed or planting vegetation. Dispose of material that is moved offsite in such a manner as to prevent its entry into any ditch, watercourse, wetland, floodplain, ravine or storm sewer system.

- .4 Use fill that is inert material in accordance with the Contract and free from contaminants. Place fill so that it cannot gain entry into any ditch, watercourse, wetland, floodplain, ravine or storm sewer system.
- .5 No fill is to be stockpiled on marsh or marsh fringe areas.
- .6 Restoration of waterways impacted by Contractor's activities.
 - .1 Restore all waterways impacted by Contractor's activities associated with the Work onsite and offsite.
 - .2 Restoration includes removal of material, regrading, and revegetation to restore to original pre-impacted state.
 - .3 Submit procedures for restoration.
 - .4 Restore as instructed by the Departmental Representative.

1.9 WATERWAY IMPACT REQUIREMENTS

- .1 Meet Waterway Impact Requirements for all impacts to a waterway, including runoff, discharge, or work in or adjacent to waterways.
- .2 Meet or exceed Waterway Impact Requirements, unless specifically identified in a site-specific criteria or authorizations.
- .3 Waterway Impact Requirements:
 - .1 Laws, regulations, and permits applicable to the performance of the Work.
 - .2 *BC Approved Water Quality Guidelines* for Freshwater Aquatic Life water use.
 - .3 *CCME Canadian Environmental Quality Guidelines* for the Protection of Aquatic Life.

1.10 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
 - .1 Provide temporary enclosures where required.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .5 Pollution includes spills or other releases from Contractor's activities that could potentially contaminate soil, sediment, water, and atmosphere from discharge of hazardous, deleterious or regulated substances, including from equipment and material handling.

- .6 The Contractor is responsible for all costs associated with a spill, leak, or other release of a deleterious substance as a result of their Work. This will include costs of spill response equipment and materials, associated sampling and analysis, and any required restoration of the impacted area.
- .7 Provide sequence, methods and means, and facilities to prevent spills or releases.
 - .1 Maintain temporary erosion and pollution control features.
 - .2 Do not store fuel onsite other than tanks forming part of the equipment.
 - .3 Control emissions from equipment and plant to meet applicable authorities' emission requirements.
 - .4 Contractor to regularly inspect all machinery on the Site to ensure it is in good repair and free of leaks.
- .8 Inadequate procedures:
 - .1 Stop relevant Work if procedures are inadequate to prevent spills or other releases, or when monitoring indicates that release equals or exceeds regulated or levels in accordance with the Contract.
 - .2 Submit procedures proposed to resolve problem.
 - .3 Make necessary changes to operations prior to resuming excavation, handling, processing, or other Work that can cause spills or other releases.
 - .4 Departmental Representative can stop relevant Work at any time when Contractor's Work procedures are inadequate to prevent spills or other releases, or when monitoring indicates that release equals or exceeds regulated or levels in accordance with the Contract. Do not proceed with stopped Work until corrections accepted by Departmental Representative.
- .9 Be prepared to intercept, cleanup, and dispose of spills or other releases that can occur whether on land or water.
- .10 Spill kits and containment are to be maintained onsite and ready for deployment in the event of spills or other releases.
 - .1 Spill kits are to include sufficient quantities of absorbent material, containers, booms, shovels and other tools, and personal protective equipment.
 - .2 Spill response materials are to be compatible with type of equipment being used or type of material being handled.
 - .3 Spill kits are to be in close proximity to machinery.
 - .4 During the Work there are to be trained and qualified personnel available that are ready to deploy spill kits when necessary.
- .11 Take immediate action using available resources to contain and mitigate effects on environment and persons from spill or release.
- .12 Promptly report spills and releases potentially causing damage to environment to:
 - .1 Authority having jurisdiction or interest in spill or other release including conservation authority, water supply authorities, drainage authority, road authority, and fire department.
 - .2 Contractor emergency response team including Superintendent

- .3 Departmental Representative and other contractor(s) and individuals as instructed by the Departmental Representative.
- .13 Departmental Representative can collect samples for chemical analyses prior to, during, and upon Final Completion of Work to monitor potential pollution caused by Contractor's activities. Assist Departmental Representative in collection of samples.
- .14 Remediation of soil, sediment or water contaminated by Contractor's activities.
 - .1 Remediate all soil, sediment or water contaminated by Contractor's activities associated with the Work onsite and offsite.
 - .2 Remediation includes excavation, pumping, testing, transport, treatment and disposal as appropriate for the type of contamination incurred, in accordance with the Contract.
 - .3 Submit procedures for remediating soil, sediment or water contaminated by Contractor's activities.
 - .4 Remediate as instructed by the Departmental Representative.
 - .5 Contractor is responsible for any additional investigation, testing, and assessments required as acceptable to the Departmental Representative.

1.11 DUST AND PARTICULATE CONTROL

- .1 Execute Work by methods to minimize raising dust from construction operations.
- .2 Prevent fugitive dust from the Site from interfering with onsite and offsite uses.
- .3 Prevent dust from spreading to neighbouring properties.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads, excavations, and stockpiles.
- .5 Implement and maintain dust and particulate control measures immediately as instructed by the Departmental Representative during Work and in accordance with regulations and in accordance with the Contract.
- .6 Provide positive means to prevent airborne dust from dispersing into atmosphere. Use fresh (non-saline) water for dust and particulate control.
- .7 As minimum, use appropriate covers on vehicles, including trucks, barges, and trains, hauling fine or dusty material. Use watertight vehicles to haul wet materials.
- .8 Inadequate procedures:
 - .1 Stop relevant Work if dust and particulate control is not sufficient for controlling dusts and particulates into atmosphere, or when monitoring indicates that dust or particulate levels equal or exceed regulated or levels in accordance with the Contract.
 - .2 Submit procedures proposed to resolve problem.
 - .3 Make necessary changes to operations prior to resuming excavation, handling, processing, or other Work that can cause release of dusts or particulates.

- .4 Departmental Representative can stop relevant Work at any time when Contractor's Work procedures are inadequate to prevent release of dusts or particulates, or when monitoring indicates that dust or particulate levels equal or exceed regulated or levels in accordance with the Contract. Do not proceed with stopped Work until corrections accepted by Departmental Representative.

1.12 WASTE DISPOSAL

- .1 Remove all Waste within Work areas in accordance with the Contract and as instructed by the Departmental Representative.
- .2 Assume ownership of, and be responsible for, Waste once it is loaded on a vehicle, barge, or other vessel for transport offsite.
- .3 Remove surplus materials and temporary facilities from Site.
- .4 Dispose waste offsite.
- .5 Do not burn or bury any waste onsite.
- .6 Do not discharge wastes into streams or waterways.
- .7 Do not dispose of volatile or hazardous materials such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
- .8 Dispose of following materials at appropriate Landfill identified by Contractor and accepted by Departmental Representative:
 - .1 Non-Contaminated Waste.
 - .2 Disposable PPE that has not become contaminated.

1.13 SEWAGE WASTEWATER

- .1 Store Sewage Wastewater from toilet facilities with wastewater from handbasins, and/or showers, for ultimate disposal.
- .2 Provide, operate, and maintain Sewage Wastewater storage tanks to store Sewage Wastewater.
- .3 Transport and dispose of Sewage Wastewater at a Disposal Facility, or discharge to municipal sanitary sewer system in compliance with Municipal requirements, as accepted by Departmental Representative.
- .4 Discharges: comply with applicable discharge limitations and requirements; do not discharge Sewage Wastewater to Site sewer systems that do not conform to or are in violation of such limitations or requirements; and obtain approval prior to discharge of Sewage Wastewater.

1.14 WASTEWATER CONTROL

- .1 Dewater various parts of Work including, without limitation, excavations, structures, foundations, and Work areas.

- .2 Employ construction methods, plant procedures, and precautions that ensure Work, including excavations, are stable, free from disturbance, and dry.
- .3 Direct surface waters that have not contacted potentially Contaminated Wastes to surface drainage systems.
- .4 Control surface drainage including ensuring that gutters are kept open, wastewater is not allowed across or over pavements or sidewalks except through accepted pipes or properly constructed troughs, and runoff from unstabilized areas is intercepted and diverted to suitable outlet.

1.15 WASTEWATER DISPOSAL

- .1 Dispose of Wastewater in manner not injurious to public health or safety, to property, or to any part of Work completed or under construction.
- .2 Control disposal or runoff of Wastewater containing suspended materials or other harmful substances in accordance with local authority requirements.
- .3 Ensure pumped Wastewater into waterways, sewer or drainage systems is free of suspended materials. Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas
- .4 Obtain permits to discharge Wastewater to environment or Municipal sewers.
- .5 Do not discharge water directly offsite to the environment or to municipal sewers which may have come in contact with potentially Contaminated Waste or potentially Contaminated Wastewater or otherwise may have become Contaminated Wastewater.

1.16 EROSION AND SEDIMENT CONTROL

- .1 Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other Work areas. Prevent erosion and sedimentation.
- .2 Minimize amount of bare soil or sediment exposed at one time. Stabilize disturbed soil or sediment as quickly as practical. Strip vegetation, regrade, or otherwise develop to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and water courses, and repair damage caused by soil erosion and sedimentation as instructed by the Departmental Representative.
- .3 Provide and maintain temporary erosion and sediment control measures.
 - .1 Temporary erosion and sediment control measures are required to prevent erosion and migration of silt, mud, sediment, and other debris offsite or to other areas of Site where damage might result, or that might otherwise be required by laws and regulations.
 - .2 Temporary erosion and sediment control measures include: silt fences, hay or straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, vegetative cover, dikes, mulching, sediment traps, detention and

- retention basins, grading, planting, retaining walls, culverts, pipes, guardrails, temporary roads, and other measures appropriate to specific condition.
- .3 Temporary improvements to remain in place and in operation as necessary or until otherwise instructed by the Departmental Representative
 - .4 Place silt fences and/or hay or straw bales in ditches to prevent sediment from escaping from ditch terminations.
 - .5 Do not construct bale barriers and silt fence in flowing streams or in swales.
 - .6 Check erosion and sediment control measures weekly after each rainfall; during prolonged rainfall check daily.
 - .7 Bales and/or silt fence can be removed at beginning of Working Day, replace at end of Working Day.
 - .8 Repair damaged bales, end runs, and undercutting beneath bales.
 - .9 Unless instructed by the Departmental Representative, remove temporary erosion and sediment control devices upon Final Completion of Work. Temporary erosion and sediment control devices once removed become property of Contractor.
- .4 Whenever sedimentation is caused by stripping vegetation, regrading, or other development, remove it from adjoining surfaces, drainage systems, and watercourses, and repair damage as quickly as possible.
 - .5 Construct fill areas to prevent erosion.
 - .6 Do not disturb existing embankments or embankment protection in accordance with the Contract.
 - .7 Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
 - .8 If soil, sediment and debris from Site accumulate in low areas, storm sewers, roadways, gutters, ditches, or other areas where it is undesirable, remove accumulation and restore area to original condition, as instructed by the Departmental Representative.

1.17 NOTIFICATION

- .1 Departmental Representative or Consultant 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, or other environmental procedure violations.
- .2 Contractor: after receipt of such notice, inform Departmental Representative or Consultant of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Do not take action until after receipt of written approval by Departmental Representative or Consultant.
- .3 Departmental Representative or Consultant 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.

1.18 VIBRATION

- .1 Maintain acceptable vibration levels as to not damage structures adjacent to the Site as a result of the Work.

1.19 MAINTENANCE OF PUBLIC ROADS

- .1 Prevent tracking or spilling of debris or material onto public roads.
- .2 Immediately sweep or scrape up debris or material on public roads.
- .3 Clean public roads within a 200 m radius of the Site entrance at least once per shift.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Demolition Waste Management and Disposal.
- .3 Rubbish and waste materials are not to be buried on site
- .4 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Written and electronic reports.
- .4 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

- .1 01 61 10 - Product Requirement.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 ISO/IEC 17025-2005 - General Requirements for the Competence of Testing and Calibration Laboratories.
- .2 SCC (Standards Council of Canada)

1.4 REVIEW BY DEPARTMENTAL REPRESENTATIVE

- .1 Departmental Representative may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.
- .2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.
- .3 If such Work is found in accordance with Contract Documents, Departmental Representative will pay cost of review and replacement.

1.5 INDEPENDENT INSPECTION AGENCIES

- .1 The Contractor shall engage and pay for Independent Inspection and Testing Agencies for purpose of inspecting and testing portions of Work.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection and 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 shall request additional inspection and 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 re-inspection.

1.6 ACCESS TO WORK

- .1 Allow inspection and testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Cooperate to provide reasonable access and facilities for such access.

1.7 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 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.

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

1.9 REPORTS

- .1 Submit four (4) paper copies of signed inspection and test reports to Departmental Representative.
- .2 Provide signed paper copies to manufacturer or fabricator of material being inspected or tested.

1.10 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.

1.11 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Temporary utilities.
- .2 Salvaging products for reuse.

1.2 RELATED SECTIONS

- .1 Section 01 52 00 - Construction Facilities.

1.3 ACCESS AND DELIVERY

- .1 Only the designated entrance may be used for access to Site.
 - .1 Maintain for duration of Contract.
 - .2 Make good damage resulting from Contractor's use.
- .2 Use of the Site will be granted to the Contractor through the Departmental Representative.

1.4 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Salvage and assist in recycling products for potential reuse.
- .3 Remove temporary facilities from Site when determined by the Departmental Representative.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.5 SIGNS AND NOTICES

- .1 Signs and notices for safety and instruction will be in both official languages or graphic symbols conforming to CAN/CSA-Z321.
- .2 Maintain accepted signs and notices in good condition for duration of project, and dispose of offsite on completion of project or when determined by Departmental Representative.

1.6 FIRE PROTECTION

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

1.7 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and Site and soil stockpiles free from standing water.

1.8 STORAGE FACILITIES

- .1 Storage space will be limited to the area of construction.

1.9 WATER SUPPLY

- .1 Owner will provide continuous supply of potable water for construction use.
- .2 Arrange for connection and pay all costs for installation, maintenance and removal.

1.10 SANITARY FACILITIES

- .1 Sanitary facilities are not available at existing Site and must be supplied at no cost.

1.11 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 degrees 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 Ensure date of Substantial Performance of the Work and Warranties for heating system do not commence until entire system is in as near original condition as possible and is reviewed by Departmental Representative.
- .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.

1.12 TEMPORARY POWER AND LIGHT

- .1 Power is not available from the Owners facilities.
- .2 Provide and pay for temporary power required to undertake and complete this work.120
- .3 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.

1.13 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary high speed internet and telephone hook up, line/lines equipment necessary for own use and use of departmental representative.

Part 2 PRODUCTS

- 2.1 Not used**

Part 3 EXECUTION

- 3.1 Not used**

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Construction aids.
- .2 Office and sheds.
- .3 Parking.
- .4 Project identification.

1.2 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.4 SCAFFOLDING

- .1 Provide and maintain ladders, platforms and scaffolding.

1.5 HOISTING

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists shall be operated by qualified operator.

1.6 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work and continuing operation of the facility.
- .2 Provide and maintain adequate access to project site.

1.7 OFFICES

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table.
- .2 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.8 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.

1.9 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.
- .3 Except where connected to municipal sewer system, periodically remove wastes from Site.

- .4 New permanent facilities may not be used without approval of Departmental Representative.
- .5 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

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 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

1.4 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.

1.5 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.

1.6 ACCESS TO SITE

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

1.7 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 public.

1.8 FIRE ROUTES

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

1.9 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.

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

Part 2 Product

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 SECTION INCLUDES

- .1 Create an erosion and sediment control plan.
- .2 Prevent loss of soil during construction by storm water runoff and wind erosion.
- .3 Protect stockpiled topsoil.
- .4 Prevent sedimentation of storm water and receiving streams.
- .5 Prevent pollution of the air with dust and particulate matter.

1.2 RELATED SECTIONS

- .1 Section 31 23 16 - Excavating.

1.3 DEFINITIONS

- .1 Erosion: Deterioration, displacement, or transportation of land surface by wind or water, intensified by land-clearing practices related to construction activities.
- .2 Rain or Rain Storm: An event defined causing the pooling of water on road or other impervious surfaces.
- .3 Sediment: Particulate matter transported and deposited as a layer of solid particles within a body of water.
- .4 Snow Melt: An event in snow conditions when the temperature is above 0 degrees C or when environmental conditions causing snow on the ground to melt.

1.4 SUBMITTALS

- .1 Provide requested information in accordance with Section 01 33 00 – Submittals.
- .2 Provide within seven (7) days of date established for commencement of the Work.

Part 2 Products

2.1 SILT FENCING

- .1 Posts: Steel "T" cross section, of lengths as required.
- .2 Geotextile: Woven polypropylene filter fabric, resistant to ultra-violet degradation.

2.2 STOCKPILING

- .1 Prevent cleared topsoil and excavated earth stockpiled on site from being eroded by rain storm, snow melt or wind.
- .2 Install silt fencing.
- .3 Maintain silt fencing at a height of no less than 400 mm above grade, and no greater than 800 mm.
- .4 Extend geotextile filter fabric 150 mm below grade, and return 150 mm towards the opposite direction of flow.
- .5 Space posts not further than 1800 mm apart.
- .6 Limit operation of vehicles on site to paved surfaces or temporary gravel surfaces in order to avoid the disturbing soil.

END OF SECTION

1.1 PRODUCTS/MATERIAL AND EQUIPMENT

- .1 Use NEW products/material and equipment unless otherwise specified. The term “products” is referred to throughout the specifications.
- .2 Use products of 1 manufacturer for material and equipment of the same type or classification unless otherwise specified.
- .3 Unless otherwise specified, comply with manufacturer’s latest printed instructions for materials and installation methods.
- .4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer’s instructions. Departmental Representative will designate which document is to be followed.
- .5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.
 - .1 Prevent electrolytic action between dissimilar metals.
 - .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.
- .6 Fastenings which cause spalling or cracking are not acceptable.
- .7 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .8 Use heavy hexagon heads, semi-finished unless otherwise specified.
- .9 Bolts may not project more than 1 diameter beyond nuts.
- .10 Types of washers as follows:
 - .1 Plain type washers: use on equipment and sheet metal.
 - .2 Soft gasket lock type washers: use where vibrations occur.
 - .3 Resilient washers: use with stainless steel.
- .11 Deliver, store and maintain packaged material and equipment with manufacturer’s seals and labels intact.
- .12 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.
- .13 Store products in accordance with suppliers’ instructions.
- .14 Touch up damaged factory finished surfaces to Departmental Representative’s satisfaction:
 - .1 Use primer or enamel to match original.
 - .2 Do not paint over nameplates.

1.2 QUALITY OF PRODUCTS

- .1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.
- .2 Defective products will be rejected regardless of previous inspections.

- .1 Inspection does not relieve responsibility, but is precaution against oversight or error.
- .2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.
- .4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract documents.
- .5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.
- .6 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.

1.3 AVAILABILITY OF PRODUCTS

- .1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items.
- .2 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 the work.
- .3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

1.4 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in the specifications, install or erect products in accordance with the manufacturer's instructions.
 - .1 Do not rely on labels or enclosures provided with products.
 - .2 Obtain written instructions directly from the manufacturer.
- .2 Notify Departmental Representative in writing of conflicts between the specifications and the manufacturer's instructions so that the Departmental Representative may establish the course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in either the Contract price or the Contract time.

1.5 CONTRACTOR'S OPTIONS FOR SELECTION OF PRODUCTS FOR TENDERING

- .1 Products are specified by "**Prescriptive**" specifications: select any product meeting or exceeding specifications.
- .2 Products specified under "**Acceptable Products**" (used for complex Mechanical or Electrical Systems): select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.

- .3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.
- .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with “Special Instructions to Tenderers”.
- .5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative obtain from manufacturer and independent laboratory report showing that the product meets or exceeds the specified requirements.

1.6 SUBSTITUTION AFTER CONTRACT AWARD

- .1 No substitutions are permitted without prior written approval of the Departmental Representative.
- .2 **Proposals for substitution may only be submitted after Contract award.** Such request must include statements of respective costs of items originally specified and the proposed substitution.
- .3 Proposals will be considered by the Departmental Representative if:
 - .1 products selected by tenderer from those specified are not available;
 - .2 delivery date of products selected from those specified would unduly delay completion of Contract, or
 - .3 alternative product to that specified, which is brought to the attention of considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
- .4 **Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.**
- .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.

END OF SECTION

1. PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Preconstruction Condition Survey: within 10 Working Days prior to mobilization to Site, Submit Preconstruction Condition Survey of existing structures, utilities and surface features.
- .2 Preconstruction As-Built Documents: at least 5 Working Days prior to mobilization to Site, Submit preconstruction as-built documents prepared by a Land Surveyor.

1.2 QUALIFICATIONS OF SURVEYOR

- .1 A BC registered Land Surveyor, acceptable to Departmental Representative.

1.3 SURVEY REFERENCE POINTS

- .1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .2 Make no changes or relocations without prior written notice to Departmental Representative.
- .3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .4 Require surveyor to replace control points in accordance with original survey control.

1.4 SURVEY REQUIREMENTS

- .1 Establish permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, 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.

1.5 EXISTING SERVICES

- .1 Size, depth and location of existing utilities and structures as specified are for guidance only. Completeness and accuracy are not guaranteed.
- .2 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative. Confirm all utilities entering Site prior to subsurface disturbance (ie do not rely on as-built documents). As appropriate, confirm locations of buried utilities by independent utility locator and using hand test excavations or hydrovac methods.
- .3 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.
- .4 Maintain and protect from damage all utilities and structures encountered, unless Work involves temporarily breaking, rerouting, or connecting into existing utilities.
- .5 Where Work involves temporarily breaking, rerouting, or connecting into existing utilities, obtain permission from utility companies of intended interruption of services, and carry out Work at times determined by the authorities having jurisdiction.

- .6 Submit schedule to and obtain approval for any shutdown or closure of active service. Adhere to schedule accepted by Departmental Representative and provide notice to affected parties.
- .7 Provide temporary services as required to maintain critical building and tenant systems.
- .8 Where unknown utilities are encountered, immediately verbally notify Departmental Representative and confirm findings in writing.

1.6 EXAMINATION

- .1 Examine Site and Contract and be familiar and conversant with existing conditions likely to affect Work, including Contaminated Waste.

1.7 RECORDS

- .1 Land Surveyor to prepare preconstruction as-built drawings of all utilities.
- .2 Land Surveyor to prepare postconstruction as-built drawings of all utilities, including existing, reinstated, rerouted, and abandoned.
- .3 Maintain a complete, accurate log of control and survey work as it progresses.
- .4 Preconstruction Condition Survey:
 - .1 Conduct Preconstruction Condition Survey of existing structures and other features which can be affected by Work, both onsite and offsite. Includes: buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, roads, survey bench marks, monuments and other features.
 - .2 Survey to include detailed photographic documentation of any preconstruction damage, and measurements where appropriate, including crack width and length, angles out of true. Record written notices to owners of features that have existing damage.

Part 2 PART 2 - PRODUCTS

- .1 Not Used

Part 3 PART 3 - EXECUTION

- .1 Not Used

END OF SECTION

Part 1 General

1.1 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 daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Consultant.
- .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 marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 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, floors .
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Inspect finishes, fitments and equipment and ensure specified workmanship and

- operation.
- .12 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .13 Remove dirt and other disfiguration from exterior surfaces.
- .14 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .15 Sweep and wash clean paved areas.
- .16 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .17 Clean roofs, downspouts, and drainage systems.
- .18 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .19 Remove snow and ice from access to building.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Product

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 GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Waste Management Plan and Goals.
- .2 Waste Management Goal: Wood, concrete and metal Project Waste to be diverted from landfill sites unless not safe to do so (e.g. contaminated with mould, rodent/avian waste or other hazardous building materials). Provide Departmental Representative documentation certifying that waste management, recycling and/or reuse of recyclable and reusable materials have been extensively practiced.
- .3 Accomplish maximum control of solid demolition waste.
- .4 Preserve environment and prevent pollution and environment damage.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

- .1 Canadian Environmental Protection Act (CEPA)
 - .1 CCME PN 1326-[2008], Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .2 CSA International
 - .1 CSA S350-[M1980(R2003)], Code of Practice for Safety in Demolition of Structures.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 2012, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.4 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
- .2 Demolition Waste Audit (DWA): relates to actual waste generated from project.
- .3 Inert Fill: inert waste - exclusively asphalt and concrete.
- .4 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

- .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. 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 re-modelling 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 Separate Condition: refers to waste sorted into individual types.
- .10 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .11 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .12 Waste Reduction Work plan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from DWA (Schedule A).

1.5 DOCUMENTS

- .1 Maintain at job site, one copy of each of the following documents:
 - .1 Demolition Waste Audit.
 - .2 Waste Reduction Work plan.
 - .3 Material Source Separation Plan.
 - .4 Schedules A and B completed for project.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule A.
 - .2 Submit 2 copies of completed Waste Reduction Work plan (WRW): Schedule B.
- .3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
 - .1 Failure to submit could result in hold back of final payment.

- .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled or disposed of.
- .3 For each material reused, sold or recycled from project, include amount in tonnes and the destination.
- .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.7 DEMOLITION WASTE AUDIT (DWA)

- .1 Prepare DWA prior to project start-up.
- .2 Complete DWA: Schedule A.
- .3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.8 WASTE REDUCTION WORK PLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
 - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.9 STORAGE, HANDLING AND PROTECTION

- .1 Store materials to be reused, recycled and salvaged in locations as directed by Departmental Representative or Consultant.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative and Consultant.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Separate and store materials produced during dismantling of structures in designated areas.
- .9 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.

1.10 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner or any other liquid hazardous wastes into waterways, storm, or sanitary sewers.
- .3 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.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.
- .6 Waste Disposal:
 - .1 Divert materials which can be practically reused or recycled from Landfill.

- .2 Dispose all other Waste in Landfill.
- .7 Landfill requirements:
 - .1 Be an existing offsite facility located in Canada.
 - .2 Hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of Waste.
 - .3 Dispose material as soon as practical and within 10 Working Days of leaving Site unless otherwise accepted by Departmental Representative.
 - .4 Permanently store material sent to a Landfill at that facility.
 - .5 If proposed Landfill is not acceptable to Departmental Representative, identify an alternate Landfill that is acceptable.
- .8 Submit recycling receipts or landfill receipts for all material disposed offsite.

1.11 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Provide temporary security measures approved by Departmental Representative.

1.12 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 SELECTIVE DEMOLITION

- .1 Investigating options for reuse of Building Elements is to be made a priority of this project. This may include:
 - .1 Subsequent to the removal of hazardous building materials, retaining the services of a salvage company to review the buildings and structures to assess whether building components (e.g. windows, doors, etc.) have salvage value, and to complete the salvage of those materials deemed appropriate.
 - .1 Documentation of materials that can/cannot be salvaged is to be provided to Departmental Representative.

3.2 APPLICATION

- .1 Do Work in compliance with WRW.

- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.3 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.

3.4 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 On-site sale of salvaged, recovered, reusable and/or recyclable materials is permitted.

.3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Doors and Frames	[100]	[]
Electrical Equipment	[80]	[]
Mechanical Equipment	[100]	[]
Metals	[100]	[]
Concrete	[100]	[]
Wood (uncontaminated)	[100]	[]
Other		[]

3.5 DEMOLITION WASTE AUDIT (DWA)

- .1 Schedule A - Demolition Waste Audit (DWA):

(1) Material Description	(2) Quantity	(3) Unit	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks and Assumptions
Wood						
Wood Stud						
Plywood						
Baseboard-Wood						
Door Trim - Wood						
Cabinet						
Doors and						

(1) Material Description	(2) Quantity	(3) Unit	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks and Assumptions
Windows						
Panel Regular						
Slab Regular						
Wood Laminate						
Byfold - Closet						
Glazing						

3.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B:

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destination
Doors							
Windows							
Hardware							
Painted Frames							
Glass							
Wood							
Metal							
Other							

3.7 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule C - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
British Columbia	Ministry of Environment Lands and Parks 810 Blanshard Street, 4 th Floor Victoria BC V8V 1X4	604-387-1161	604-356-6464
	Waste Reduction Commission Soils and Hazardous Waste 770 South Pacific Blvd, Suite 303 Vancouver	604-660-9550	604-660-9596

Province	Address	General Inquires	Fax
	BC V6B 5E7		

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Starting equipment in preparation for adjusting and commissioning.
- .2 To bring the facility to a fully operational state, free of deficiencies, in the most efficient and timely manner achievable.

1.2 RELATED SECTIONS

- .1 Section 01 79 00 - Demonstration and Training.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SUBMISSIONS

- .1 Advise Commissioning Agent of report forms required for equipment and systems but not yet supplied by the commissioning agent.
- .2 Provide a sample of manufacturer's start-up forms for equipment or systems not included.
- .3 Submit and completed and verified commissioning manual to the Owner with all data entered and sign-offs, prior to Substantial Completion of the Work.

Part 2 Products

2.1 NOT USED.

- .1 Not Used.

Part 3 Execution

3.1 STARTING SYSTEMS

- .1 Coordinate schedule for start-up of various equipment and systems.
- .2 Notify Departmental Representative , seven (7) days prior to start-up of each item.
- .3 Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- .4 Verify tests, metre readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- .5 Verify that wiring and support components for equipment are complete and tested.
- .6 Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' written instructions.
- .7 When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- .8 Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

3.2 START-UP REPORT

- .1 Commissioning agent will provide start up report forms (check sheets) with the

- exception of controls.
- .2 Contractor to develop, complete and provide the report forms for all control points, software and hardware.
- .3 Submit completed report forms to commissioning agent for review within ninety (90) days of award of contract.
- .4 Commissioning agent will assemble completed report forms into a "commissioning manual" on the following subjects:
 - .1 Each mechanical system (except for controls).
 - .2 Each electrical system.
- .5 Include manufacturer's equipment start-up reports and test certificates as an appendix to the commissioning manual.
- .6 The commissioning manual will be kept on site for use by appropriate contractors and the commissioning agent.
 - .1 Maintain this manual current.
 - .2 Maintain a schedule for work of the commissioning agent in conjunction with the commissioning schedule.
- .7 The report forms are divided into three parts:
 - .1 Technical Data.
 - .2 Static Checks.
 - .3 Operational Checks.
- .8 Contractor is to complete each part prior to verification by the commissioning agent.
- .9 Contractor is responsible for completing the report forms as follows and as indicated on the attached sample:
 - .1 Technical Data.
 - .1 Specified: Commissioning Agent.
 - .2 Shop Drawing: Contractor.
 - .3 Installed: Contractor.
 - .4 Verified: Commissioning Agent.
 - .5 Date/Checked By: Contractor to sign when all shop drawing and installed information is completed.
 - .2 Static Checks.
 - .1 Confirmation of Completion: Contractor to confirm all items listed are completed prior to verification by the commissioning agent.
 - .2 Date / Checked By: Contractor to sign when the installation of the equipment and or systems are complete and ready for the commissioning agent to verify.
 - .3 Operational Checks.
 - .1 Operational checks will be performed by the commissioning agent using the balancing report and control's forms.

3.3 CONTRACTOR START UP

- .1 Contractor to perform the following during start-up:
 - .1 Start equipment and systems.
 - .2 Test, adjust and balance equipment and systems as specified in Section 01 75 19.

- .3 Demonstrate equipment and systems as specified in Section 01 79 00.
- .2 Complete and submit start-up reports including:
 - .1 Contractor's system and equipment start up reports.
 - .2 Manufacturers' equipment start up reports.
- .3 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with requirements of Contract Documents.
- .4 Correct Contract deficiencies and defects identified as a result of the foregoing and as may be identified by the owner.
- .5 Execute and complete approved Change Orders.
- .6 Perform other work and activities required for fulfillment of prerequisites to Substantial Performance of the Work.
- .7 Commissioning Agent will perform the following during start-up:
 - .1 Perform preliminary interim inspections as necessary.
 - .2 Witness manufacturers' equipment start-up.
 - .3 Verify starting, testing, adjusting and balancing by Contractor.
 - .4 Provide start-up reports for all systems and equipment and review and approve Contractor start-up reports.
 - .5 Cooperate in systems and equipment demonstration and instruction.
 - .6 Initiate Change Orders as required.
 - .7 Verify correction of Contract deficiencies and defects by Contractor.
 - .8 Verify execution of Change Orders performed by Contractor.
 - .9 Perform other activities related to Substantial Completion of the Work as specified in Section 01 91 00.
- .8 The following will be performed to an on-going cycle of:
 - .1 Departmental Representative's field Review.
 - .2 Documentation of results.
 - .3 Diagnosis of problems.
 - .4 Correction of Contract Deficiencies and execution of Change Orders as required.
 - .5 Verification of results.

3.4 PERFORMANCE TESTING

- .1 Performance testing will be performed by the Commissioning Agent and:
 - .1 Completed prior to Substantial Completion.
 - .2 Completed when all systems have been balanced and tested and are operating to the satisfactory of the Commissioning Agent.
- .2 Contractor to perform the following during Performance Testing:
 - .1 Correct Contract deficiencies and defects previously outstanding and those identified during performance testing.
 - .2 Execute Change Orders.
- .3 The following will be performed to an on-going cycle of:
 - .1 Performance testing.
 - .2 Documentation of results.
 - .3 Diagnosis of problems.
 - .4 Correction of Contract deficiencies, defects and execution of Change Orders

as required.

.5 Verification of results.

3.5 SEASONAL CONSTRAINTS

.1 Notwithstanding requirements in this section, additional separate cycles of Contractor start-up, performance testing and fine tuning may be necessitated at a later time on equipment and systems whose full operation is dependent on seasonal conditions.

.2 Contractor's responsibilities with respect to later facility start-up activities are specified in this section.

3.6 PARTIAL UTILIZATION OF WORK

.1 When partial utilization of the Work is required, the applicable requirements specified in this section apply to the part(s) of the Work to be utilized.

3.7 THIRD PARTY TESTING

.1 Third party independent testing will be carried out for the following prior to substantial completion.

.2 Structural:

.1 Concrete testing.

.3 Cooperate with independent testing agencies to enable thorough and detailed testing of all systems and equipment.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct 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 submit verification that corrections have been made.
 - .2 Request Departmental Representative inspection.
 - .2 Departmental Representative Review:
 - .1 Departmental Representative and Contractor to review Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, balanced and fully operational.
 - .4 Certificates required by Utility companies: submitted.
 - .5 Operation of systems: demonstrated to Owner's personnel.
 - .6 Commissioning of mechanical systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements and copies of final Commissioning Report submitted to Departmental Representative.
 - .7 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
 - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Product

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 SUBMITTALS

- .1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- .2 Revise content of documents as required before final submittal.
- .3 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Phasing of Submission:
 - .1 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, neither damaged nor defective, and of same quality and manufacture as products provided in work.
- .6 Provide evidence, if requested, for type, source and quality of products supplied.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

1.2 FORMAT

- .1 Organize data as instructional manual and electronic manual.
- .2 Binders: hard covered, expandance metal post, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 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.
 - .1 Bind in with text; fold larger drawings to size of text pages.

1.3 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Title of Project
 - .2 Date of submission; names.
 - .3 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .4 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 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.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.4 AS -BUILT DOCUMENTS

- .1 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Extents of the remedial excavation as determined by the contractor's surveyor and approved by the Departmental Representative.
 - .4 Area disturbed by the remedial excavation.
 - .5 Field changes of dimension and detail.
 - .6 Addenda.
 - .7 Changes made by change orders and other modifications to Contract.
 - .8 Details not on original Contract drawings..
 - .9 References to related shop drawings and modifications.
 - .10 Field test records.
 - .11 Inspection certificates.
 - .12 Manufacturer's certificates.
- .2 Extents of the remedial excavation as determined by the contractor's surveyor and approved by the Departmental Representative.
- .3 Area disturbed by the remedial excavation .
- .4 Contract Specifications: legibly mark each item to record actual "Workmanship of Construction", including;
 - .1 Manufacturer, trade name, and catalogue number of each "Product/Material" actually installed, particularly optional items and substitute items.
 - .2 Changes made by addenda and change orders.
- .5 As-Built information
 - .1 Record changes in red ink.
 - .2 Mark on 1 set of drawings, specifications and shop drawings at completion of project and, before final inspection, neatly transfer notations to second set.
 - .3 Provide 1 set of CDs in AutoCAD and PDF file format with all as-built information on the CDs.
 - .4 Submit all sets for the Departmental Representative.
- .6 As required, surveying to be completed by a Land Surveyor for as-built documents
- .7 Provide digital photos for site records.
- .8 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.

- .9 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .10 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .11 Keep record documents and samples available for inspection by Departmental Representative.

1.5 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1

1.6 EQUIPMENT AND SYSTEMS

- .1 Operating procedures - include the following:
 - .1 Start-up, break-in, and routine normal operating instructions and sequences.
 - .2 Regulation, control, stopping, shutdown, and emergency instructions.
 - .3 Summer, winter, and any special operating instructions.
- .2 Maintenance requirements - list routine procedures:
- .3 Provide servicing and lubrication schedule, and list of lubricants required.
- .4 Include manufacturer's printed operation and maintenance instructions.
- .5 Include sequence of operation by controls manufacturer.
- .6 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .7 Provide installed control diagrams by controls manufacturer.
- .8 Provide Contractor's coordination drawings with installed colour coded piping diagrams.
- .9 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .10 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .11 Additional requirements: as specified in individual specification Sections.
- .12 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .13 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .14 Include installed colour coded wiring diagrams.
- .15 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .16 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.

1.7 MANUFACTURER'S DOCUMENTATION REPORTS

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and system, instruct

Departmental Representative's indicated facility's personnel, and provide detailed written report that demonstration and instructions have been completed.

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

1.8 MAINTENANCE MATERIALS

.1 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 items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.2 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 items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.9 DELIVERY, STORAGE AND HANDLING

- .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 for review by Departmental Representative.

1.10 WARRANTIES, BONDS, TEST REPORTS, INSPECTION REPORTS

- .1 Separate each Document 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, Bonds, Test Results, Inspection Reports executed in duplicate by subcontractors, suppliers, manufacturers, and inspection agencies within 10 days after completion of the applicable item of work.
- .4 Except for items put into use with the Departmental Representative's permission, leave date of beginning of time of warranty until the date 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.

- .8 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.11 COMPLETION DOCUMENTS

- .1 Submit a written certificate that the following have been performed;
 - .1 Work has been completed and inspected for compliance with the Contract documents.
 - .2 Treatment and disposal of treatable soils have been completed and disposal of all other soils has been completed.
 - .3 Defects have been corrected and deficiencies have been completed.
 - .4 Equipment and systems have been tested, adjusted and balanced, and are fully operational.
 - .5 Certificates required by the Boiler Inspection Branch, Fire Commissioner of Canada, and utility companies have been submitted.
 - .6 Operation of systems has been demonstrated to the personnel indicated by the Departmental Representative.
 - .7 Work is complete and ready for final inspection.
- .2 Prepare all documentation required as part of any permits or other authorizations obtained or otherwise the responsibility of the Contractor.

Part 2 Product

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 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.
- .2 Seminars and demonstrations.

1.2 RELATED SECTIONS

- .1 Section 01 91 00 - Commissioning.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DESCRIPTION

- .1 Demonstrate scheduled operation and maintenance of equipment to Owner's personnel two (2) weeks prior to date of final inspection.
- .2 Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 COMPONENT DEMONSTRATION

- .1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.
- .2 Instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.5 SUBMITTALS

- .1 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Consultant's approval.
- .2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.6 CONDITIONS FOR DEMONSTRATIONS

- .1 Testing, adjusting, and balancing have been performed in accordance with Section 01 91 00, and equipment and systems are fully operational.
- .2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that suitable conditions for demonstration and instructions are available.
- .2 Verify that designated personnel are present.
- .3 Prepare agendas and outlines.

- .4 Establish seminar organization.
- .5 Explain component design and operational philosophy and strategy.
- .6 Develop equipment presentations.
- .7 Present system demonstrations.
- .8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 PREPARATION OF AGENDAS AND OUTLINES

- .1 Prepare agendas and outlines including the following:
 - .1 Equipment and systems to be included in seminar presentations.
 - .2 Name of companies and representatives presenting at seminars.
 - .3 Outline of each seminar's content.
 - .4 Time and date allocated to each system and item of equipment.
 - .5 Provide separate agenda for each system.

3.3 SEMINAR ORGANIZATION

- .1 Coordinate content and presentations for seminars.
- .2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.
- .3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.
- .4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

3.4 EXPLANATION OF DESIGN STRATEGY

- .1 Explain design philosophy of each system. Include following information:
 - .1 An overview of how system is intended to operate.
 - .2 Description of design parameters, constraints and operational requirements.
 - .3 Description of system operation strategies.
 - .4 Information to help in identifying and troubleshooting system problems.

3.5 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon 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 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.
- .4 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

END OF SECTION

Part 1 PART 1 – GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
 - .2 Acronyms:
 - .1 Cx - Commissioning.
 - .2 EMCS - Energy Monitoring and Control Systems.
 - .3 O&M - Operation and Maintenance.
 - .4 PI - Product Information.
 - .5 PV - Performance Verification.
 - .6 TAB - Testing, Adjusting and Balancing.
 - .7 MSDS - Material Safety Data Sheets.
 - .8 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.
Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

- .1 The Contractor shall engage and pay for an independent 3rd party Commissioning Authority.

- .2 The Commissioning Authority shall be the same or independent from the Commissioning Agent, but shall be free from any affiliations with the Contractor or any of its subcontractors, or the Consultant team.
- .3 The Commissioning Authority represents interest of the Departmental Representative, and is responsible for overseeing all commissioning activities during the development, implementation, and post construction stages of the project.
- .4 The Commissioning Authority:
 - .1 Develops the Commissioning Plan within 6 weeks of Contract Award and make updates throughout the Cx process, to the satisfaction of the PWGSC Commissioning Manager.
 - .2 Reviews and comments on design from an operational and maintenance perspective.
 - .3 Develops Cx forms and checklists.
 - .4 Prepares training plan.
 - .5 Develops Cx Schedule.
 - .6 Develops other Cx documentation as specified.
 - .7 Witnesses and certifies performance of all commissioning activities.
 - .8 Organizes and monitors all activities as per the contract document.
 - .9 Organizes and submits all Cx deliverables.
- .5 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.
- .6 Cx to be a line item of Contractor's cost breakdown.
- .7 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .8 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .9 Departmental Representative will not issue the Certificate of Substantial Performance until:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Commissioning Authority, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Commissioning Authority.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
 - .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .2 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Commissioning Authority.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Commissioning Authority for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .3 Inform Commissioning Authority in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Commissioning Authority before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00- Submittal Procedures.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Commissioning Authority for changes to submittals and obtain written approval at least 6 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Commissioning Authority where not specified and obtain written approval at least 6 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Commissioning Authority.

1.8 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.
- .2 Commissioning Authority to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Commissioning Authority.

1.9 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Commissioning Authority to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Commissioning Authority who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days notice prior to commencement.

- .2 Commissioning Authority to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Commissioning Authority.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Commissioning Authority before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Commissioning Authority
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Commissioning Authority after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.

- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Commissioning Authority. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Commissioning Authority.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Commissioning Authority.
 - .3 If evaluation report concludes that major damage has occurred, Commissioning Authority shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Commissioning Authority for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Commissioning Authority to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Commissioning Authority for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

- .1 . Notify Commissioning Authority at least 20 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

- .1 Submit to Commissioning Authority for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
 - .3 Cx procedures to be repeatable and reported results are to be verifiable.
 - .4 Follow equipment manufacturer's operating instructions.
 - .5 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

- .1 Commissioning Authority to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Commissioning Authority within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Certificate of Substantial Performance, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Commissioning Authority in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

- .1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Commissioning Authority.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .5 Perform additional commissioning until results are acceptable to Commissioning Authority.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Commissioning Authority for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Commissioning Authority's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Commissioning Authority deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Commissioning Authority.
- .2 Report problems, faults or defects affecting Cx to Commissioning Authority in writing. Stop Cx until problems are rectified. Proceed with written approval from Commissioning Authority.

1.29 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Commissioning Authority.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.31 TRAINING

- .1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 OCCUPANCY

- .1 Cooperate fully with Commissioning Authority during stages of acceptance and occupancy of facility.

1.34 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Commissioning Authority.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.36 PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Commissioning Authority will not relieve Contractor from compliance with specified start-up and testing procedures.

1.37 DELIVERABLES

- .1 Deliverables required by the PWGSC Commissioning Manager from the Commissioning Authority:
 - .1 CX Plan and Schedule
 - .2 Accepted Shop Drawings
 - .3 Accepted PI Forms
 - .4 Accepted TAB Report
 - .5 Accepted PV Forms
 - .6 Accepted O&M Manual
 - .7 Accepted System and Integrated System Test Report
 - .8 Accepted Training and Attendance Form
 - .9 Accepted "As Built" Plans and Specifications.

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 PART 1 – GENERAL

1.1 GENERAL

.1 SUMMARY

.1 Section Includes:

- .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

1.2 REFERENCES

- .1 National Fire Protection Association (NFPA)
.2 Public Works and Government Services Canada (PWGSC)
.3 PWGSC - Commissioning Guidelines CP.4 -3rd edition-[03].
.4 Underwriters' Laboratories of Canada (ULC)

1.3 GENERAL

.1 Provide a fully functional facility:

- .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
.2 O&M personnel have been fully trained in aspects of installed systems.
.3 Optimized life cycle costs.
.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

- .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
.3 Sets out deliverables relating to O&M, process and administration of Cx.
.4 Describes process of verification of how built works meet design requirements.
.5 Produces a complete functional system prior to issuance of Certificate of Substantial Performance.
.6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
.1 Overview of Cx.
.2 General description of elements that make up Cx Plan.
.3 Process and methodology for successful Cx.

.4 Commissioning terms used in this Section:

- .1 Bumping: short term start-up to prove ability to start and prove correct rotation.

- .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

- .1 Cx Authority shall complete a Cx Plan to approximately 95% completion within 6 weeks of Contract Award.
- .2 Cx Plan to be 100% completed within 10 weeks of award of contract to take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Cx schedule.
 - .5 Contractor's, sub-contractor's, suppliers' requirements.
 - .6 Project construction team's and Cx team's requirements.
- .3 Submit completed Cx Plan to Commissioning Authority and obtain written approval.

1.5 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update every 6 weeks during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Commissioning Authority for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 The commissioning (Cx) process is a team effort throughout the life cycle of a project. The team members include:
 - .1 PWGSC Project Manager – Has overall responsibility for managing the project and demonstrating to the client that the installed systems and overall facility meet the requirements of the TOR and the Technical Requirements.
 - .2 PWGSC Commissioning Manager – Undertakes a quality assurance role on behalf of the PWGSC project team and is responsible for fulfilling the PWGSC Commissioning Quality Management System requirements; provides technical advice on O&M matters; reviews commissioning documentation from the Commissioning Authority at all stages of the project delivery and provides support to the Project Manger in matters relating to commissioning.
 - .3 Design Consultant – Develops the design solutions to meet client requirements and performance specification requirements. The Design Consultant shall engage the services of an independent qualified professional Commissioning Authority and shall engage the services of an independent Commissioning Agent.

- .4 Commissioning Authority – Develops the commissioning plan, design intent, and system operating manual; prepares commissioning specifications and other commissioning documentation including the Product Information (PI) and Performance Verification (PV) report forms; develops the training plan; monitors, witnesses, and certifies the performance of all commissioning activities as per the contract agreement; and is responsible for design, construction, and warranty-related commitments for commissioning. The appointment of a commissioning Authority does not permit the Design Consultant to abrogate traditional design responsibilities such as carrying out site supervision and ensuring that construction conforms to the design intent.
- .5 Commissioning Agent – Carries out start-up and performance verification activities and performs acceptance tests and related procedures for all equipment, systems and integrated systems under the guidance of the Commissioning Authority. This individual also coordinates commissioning activities, conducts commissioning meetings, refines the commissioning plan, refines commissioning schedule, assembles maintenance manuals, and organizes training.
- .6 Property Manager – Is responsible for assigning operational personnel to witness systems and equipment testing and to participate in training. The property manager is also responsible for the day-to-day management and operation of the completed facility after it has been accepted from the project leader or project manager.

1.7 EXTENT OF CX

- .1 Commission mechanical systems and associated equipment
 - .1 HVAC and exhaust systems
 - .2 Plumbing fixtures and piping
 - .3 EMCS Systems
 - .4 Mechanical Fuel System
 - .5 Water Supply Well
 - .6 Chemical Feed System
 - .7 Facility water distribution.
- .2 Commission electrical systems and equipment
 - .1 Lighting system
 - .2 Fire alarm system
 - .3 Power distribution systems
 - .4 Communications cabling systems
 - .5 Grounding systems

1.8 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms].

1.9 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms].

1.10 PERFORMANCE VERIFICATION (PV) REPORT

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms].

1.11 CX SCHEDULES

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Departmental Representative will monitor progress of Cx against this schedule.

1.12 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Commissioning Authority to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.13 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Substantial Performance. It is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.
 - .2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.
 - .3 Full-scale emergency evacuation exercises.

1.14 TRAINING PLANS

- .1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

1.15 FINAL SETTINGS

- .1 Upon completion of Cx to satisfaction of [Departmental Representative][DCC Representative] [Consultant] lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

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 SUMMARY

.1 Section Includes:

- .1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

- .1 Product manufacturer's installation instructions and recommended checks.
- .2 Special procedures as specified in relevant technical sections.
- .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative, supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

- .1 Commissioning Authority shall develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data. Provide forms to the Departmental Representative for approval prior to use.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Commissioning Authority provides Contractor project-specific Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician and reviewed and signed off by Commissioning Authority.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.
 - .13 Forms to be both hard copy and electronic format with typed written results.

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 SUMMARY

- .1 Section Includes:
 - .1 This Section specifies roles and responsibilities of Commissioning Training.
- .2 Related Requirements

1.2 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes Property Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

- .1 Commissioning Authority will provide:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down of equipment, components and systems.
 - .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .3 Contractor and equipment manufacturer to provide instruction on:
 - .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

- .1 Training to be detailed and duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis and trouble-shooting.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Management Manual.
 - .5 TAB and PV Reports.
- .3 Commissioning Authority, Commissioning Manager and Departmental Representative will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.6 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be [3] hours in length.
- .3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Departmental Representative will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Commissioning Authority.

1.8 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.

- .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
 - .7 Maintenance and servicing.
 - .8 Trouble-shooting diagnosis.
 - .9 Inter-Action among systems during integrated operation.
 - .10 Review of O&M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.9 VIDEO-BASED TRAINING

- .1 Manufacturer's videotapes to be used as training tool with Departmental Representative's review and written approval 3 months prior to commencement of scheduled training.
- .2 On-Site training videos:
 - .1 Videotape training sessions for use during future training.
 - .2 To be performed after systems are fully commissioned.
 - .3 Organize into several short modules to permit incorporation of changes.
- .3 Production methods to be professional quality.

Part 2 PRODUCTS

2.1 NOT USED

Part 3 EXECUTION

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Methods and procedures for demolition of the Garage, Generator Building and House #9, including basements and foundation walls, and selected utilities. Work includes removal of septic tanks and aboveground tanks containing petroleum products.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 13.43 – Special Project Procedures for Contaminated Sites.
- .3 Section 01 35 43 – Environmental Procedures
- .4 Section 01 35 33 – Health and Safety Requirements
- .5 Section 01 56 00 - Temporary Barriers and Enclosures
- .6 Section 01 57 13 – Temporary Erosion and Sediment Control
- .7 Section 01 74 21 – Demolition Waste Management Disposal.
- .8 Section 02 81 01 – Hazardous Materials
- .9 Section 02 82 00.01 – Asbestos Abatement – Minimum Precautions
- .10 Section 02 82 00.02 – Asbestos Abatement – Intermediate Precautions
- .11 Section 02 82 00.01 – Asbestos Abatement – Maximum Precautions

1.3 REFERENCES

- .1 Definitions:
 - .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.
 - .2 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.
 - .3 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.
 - .4 Waste Reduction Work plan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- .2 Reference Standards:
 - .1 Canadian Environmental Protection Act (CEPA)

- .1 CCME PN 1326-[2008], Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .2 CSA International
 - .1 CSA S350-[M1980(R2003)], Code of Practice for Safety in Demolition of Structures.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .4 U.S. Environmental Protection Agency (EPA)
 - .1 EPA CFR 86.098-10, Emission standards for 1998 and later model year Otto-cycle heavy-duty engines and vehicles.
 - .2 EPA CFR 86.098-11, Emission standards for 1998 and later model year diesel heavy-duty engines and vehicles.
 - .3 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- .5 WorkSafe BC
 - .1 British Columbia’s Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)
 - .2 “Safe Work Practices for Handling Asbestos” (2012 Edition)
 - .3 “Lead-Containing Paints and Coatings; Preventing Exposure in the Construction Industry”, 2011

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Contractor's Representative, Departmental Representative and Consultant to:
 - .1 Verify project requirements.
 - .2 Verify existing site conditions adjacent to demolition work.
 - .3 Co-ordination with other construction subtrades.
 - .2 Hold project meetings on an “as required” basis, or as requested by Departmental Representative
 - .3 Ensure key personnel attend, as required.
 - .4 WMC must document and provide verbal report on status of waste diversion activity at each meeting.
- .2 Scheduling:

- .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
 - .1 In event of unforeseen delay notify Departmental Representative and Consultant in writing (e-mail is acceptable).

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures and Section 01 74 21 - Demolition Waste Management Disposal.
- .2 WMC is responsible for fulfilment of reporting requirements.
- .3 Prior to beginning of Work on site submit detailed Waste Reduction Work plan in accordance with Section 01 74 21 - Demolition Waste Management and Disposal and indicate:
 - .1 Descriptions of and anticipated quantities of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition, if applicable.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tippage.
 - .5 Name and address of haulers, waste disposal facilities and/or waste receiving organizations (e.g. recycling or re-use facilities).
- .4 Submit copies of weigh bills, bills of lading and/or receipts from authorized disposal sites and reuse and recycling facilities for material removed from site upon completion of the project.
 - .1 Written authorization from Departmental Representative or Consultant is required to deviate from haulers, waste disposal facilities and/or waste receiving organizations listed in Waste Reduction Work plan.
- .5 Shop Drawings:
 - .1 Submit for review and approval demolition drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
- .6 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with Section 01 57 13 – Temporary Erosion and Sediment Control and authorities having jurisdiction.
 - .2 Demolition Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Ensure Work is performed in compliance with applicable Federal, Provincial/Territorial and Municipal regulations.

1.7 SITE CONDITIONS

- .1 Environmental protection:

- .1 Ensure Work is done in accordance with Section 01 35 13.43 – Special Project Procedures for Contaminated Sites.
- .2 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 Fires and burning of waste or materials is not permitted on site.
- .4 Do not bury rubbish waste materials.
- .5 Do not dispose of waste or 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 project.
- .6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
- .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction.
- .8 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .9 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .10 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads in accordance with Section 01 35 13.43 – Special Procedures for Contaminated Sites.

1.8 EXISTING CONDITIONS

- .1 Refer to the following reports attached in the Appendices, for information pertaining to the hazardous building materials that have been identified in structures to be demolished.
 - .1 Appendix B: “FY 2012/2013 Building Conditions Assessment – CBSA Port of Pleasant Camp Border Crossing, Pleasant Camp, BC”, prepared by SNC Lavalin Environment, dated March 31, 2013 (further referred to as the SNCL Report).
 - .2 Appendix C: “Hazardous Materials Assessment – Canada Border Services Agency – Pleasant Camp Port of Entry – Pleasant Camp, British Columbia”, prepared by Golder Associates, dated February 14, 2007 (further referred to as the Golder Report).
- .2 If material resembling asbestos or other substance listed as hazardous is encountered in course of demolition, stop work, take preventative measures, and notify Departmental Representative and Consultant immediately. Proceed only after receipt of written instructions have been received from Departmental Representative or Consultant.
- .3 Structures to be demolished are based on their condition at time of Tender.
 - .1 Remove, protect and store salvaged items as directed by the PWGSC Representative including;
 - .1 House 9 appliances.
 - .2 House # 9 fuel tank and appurtenances.
 - .2 Steel, copper and clear glass can routinely be recycled and should be designated as a material specified for salvage.
 - .3 Salvage items are the property of the Contractor upon removal, unless otherwise noted. Contractor is to remove salvage items from structures and from the Site. Protect and store salvaged items as required.

- .4 Contractor will take photographs of adjacent structures before commencing demolition

Part 2 Products

2.1 EQUIPMENT

- .1 Equipment and heavy machinery:
 - .1 On-road vehicles to: CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations and CEPA-SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .2 Off-road vehicles to: EPA CFR 86.098-10 and EPA CFR 86.098-11.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 PREPARATION

- .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 Section 01 57 13 – Temporary Erosion and Sediment Control and authorities having jurisdiction.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.
- .2 Protection of in-place conditions:
 - .1 Work in accordance with Section 01 35 13.43 – Special Project Procedures for Contaminated Sites.
 - .2 Prevent movement, settlement or damage of adjacent trees, landscaping, adjacent grades, properties and roadways
 - .1 Provide bracing, shoring and underpinning, as required.
 - .2 Repair damage caused by demolition as directed by Departmental Representative.
 - .3 Support affected structures and, if safety of structure being demolished appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative and Consultant.
 - .4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
- .3 Surface Preparation:
 - .1 Disconnect and remove electrical and telephone service lines entering buildings to be demolished.

- .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .2 Electrical and communication lines to be disconnected at the source. Wiring to be removed and not left coiled in service box or on pole.
- .2 Disconnect, remove and cap all mechanical and electrical services as indicated.
- .3 Septic Tanks:
 - .1 Pump out buried septic tanks, left in place.
 - .2 Remove all tanks.
 - .3 Removal in accordance with CCME, Code of Practice PN 1326.
- .4 Aboveground storage tanks and associated piping: remove and dispose in accordance with CCME PN 1326-[2008].
- .5 Do not disrupt active or energized utilities designated to remain undisturbed.

3.2 DEMOLITION

- .1 Do demolition work in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .2 Blasting operations not permitted during demolition.
- .3 Remove contaminated or dangerous materials as 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.
- .4 Prior to start of Work remove contaminated or hazardous materials as directed by Consultant from site and dispose of at designated disposal facilities in a safe manner and in accordance with TDGA and other applicable requirements the following:
 - .1 Section 02 81 01 - Hazardous Materials.
 - .2 Section 02 82 00.01 – Asbestos Abatement – Minimum Precautions
 - .3 Section 02 82 00.02 – Asbestos Abatement – Intermediate Precautions
 - .4 Section 02 82 00.01 – Asbestos Abatement – Maximum Precautions
- .5 Remove and dispose of aboveground storage tanks
 - .1 Generator Building – One (1) estimated 1,136 L diesel above-ground storage tank
 - .2 Primary Fuel tank: 22,700 litre above grade AST fuel tank.
 - .3 A work plan will be submitted to the Departmental Representative for approval describing the Contractor's proposed methods for preparation, removal, transportation and disposal of all fuel piping and tanks prior to commencement of the work.
 - .4 All product remaining in abandoned fuel piping/tanks will be drained/pumped into appropriate containers and disposed of in an acceptable manner.
 - .5 No hot work will be used when cutting/dismantling abandoned fuel piping.
 - .6 Care will be taken to ensure no spills of product occur during removal/disposal operations. Suitable oil absorbent materials, spill pans etc. will be available to prevent any spillage of products reaching the environment.
 - .7 Contractor will present for approval to the Departmental Representative the proposed method/location of disposal of all items.

- .8 Documentation proving disposal will be provided to the Departmental Representative.
- .9 Refer to Section 01 35 43 – Environmental Procedures.
- .6 Have salvage company review the buildings and structures to assess whether building components (e.g. windows, doors, etc.) have salvage value, and to complete the salvage of those materials deemed appropriate.
 - .1 If materials (e.g. doors, windows, etc.) are not to be salvaged, documentation is to be provided to Departmental Representative indicating the reasons for classifying materials as general waste.
- .7 Demolish structures.
- .8 Remove and dispose of fuel storage and distribution system
 - .1 Drain fuel piping and remove and dispose of all existing indoor fuel piping in the Generator Building and House #9, including transfer pump, filters and ancillaries
 - .2 Drain fuel piping and remove and dispose of underground fuel piping running between above-ground storage tanks and Generator Building/Houses #9, (extent, i.e. partial or full removal of u/g piping as indicated on drawings).
 - .3 Transfer fuel, remove and store for re-use one existing aboveground steel oval heating oil tank and ancillaries located in basement of House #9 and remove and dispose of redundant fuel piping.
 - .4 Transfer fuel, remove and dispose of one existing 1,136L aboveground steel oval fuel oil tank and piping located in the Generator building, including transfer pumps, filters and generator supply/return piping.
 - .5 Remove and dispose of obsolete electrical controls and wiring associated with existing fuel tanks and transfer pumps.
 - .6 Remove and dispose of existing concrete containment structure for the Main Storage Tank.
 - .7 Drain and dispose of engine fluids and remove and dispose of two 62.5 kVA diesel generator sets, including batteries, battery chargers, engine exhaust systems, etc.
 - .8 Disconnect, remove and dispose of generator control panel and switch gear, including all interconnecting electric cables between generators and control panel, dampers, block heaters, etc.
- .9 Crush concrete generated due to demolition of foundations to size suitable for recycling.
 - .1 Where possible, identify markets which will accept crushed material as aggregate.
 - .2 For further information regarding acceptable uses contact Provincial / Territorial aggregate producers associations.
- .10 Demolish and remove foundations and footings in their entirety.
- .11 At end of each day's work, leave Work in safe and stable condition.
 - .1 Protect interiors of parts not yet demolished from entry at all times.
- .12 Demolish to minimize dusting. Keep materials wetted as necessary.
- .13 Remove structural framing.
- .14 Contain fibrous materials to minimize release of airborne fibres while being transported.

- .15 Only dispose of material specified by selected alternative disposal option.
 - .1 Additional disposal options to be provided by on-site waste diversion representative prior to disposal.
- .16 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
- .17 Use natural lighting to do Work where possible.
 - .1 Shut off lighting except those required for security purposes at end of each day.

3.3 CLEANING

- .1 Develop Waste Reduction Work plan related to Work of this Section.
- .2 Waste Management: separate and document waste materials for reuse and recycling in accordance with Section 01 74 21 - Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .3 Divert excess materials from landfill to approved site.
- .4 Designate appropriate security resources / measures to prevent vandalism, damage and theft.
- .5 Locate stockpiled materials convenient for loading into containers for off-site recycling or disposal. Eliminate double handling wherever possible.
- .6 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.
- .7 Separate from general waste stream each of following materials, where safe to do so and/or where not removed for disposal as part of hazardous materials abatement. Stockpile materials in neat and orderly fashion in location and as directed by Departmental Representative and/or Consultant for alternate disposal. Stockpile materials in accordance with applicable fire and safety regulations.
 - .1 Glass fibre ceiling tiles.
 - .2 Power source poles deemed unfit for reuse by Departmental Representative.
 - .3 Wiring and conduit.
 - .4 Outlets/switches.
 - .5 Floor receptacles.
 - .6 Metal duct work, baffles, HVAC equipment.
 - .7 Demountable partitions.
 - .8 Insulation batts.
 - .9 Miscellaneous metals.
- .8 Supply separate, clearly marked disposal bins for categories of waste material. Please notify Departmental Representative and/or Consultant prior to removal of bins from site.
- .9 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete, or materials stockpiled will fill one transport container.

- .10 Transport material designated for alternate disposal using approved haulers, waste disposal facilities and/or waste receiving organizations listed in Waste Reduction Work plan and in accordance with applicable regulations.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers, waste disposal facilities and/or waste receiving organizations listed in Waste Reduction Work plan.
- .11 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal facilities must be those approved of and listed in Waste Reduction Work plan.
 - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Work plan.

END OF SECTION

1. PART 1 - GENERAL

1.1. Definitions

- 1.1.1. Commercial Land Use: the use of land for the primary purpose of buying, selling or trading of merchandise or services including, without limitation, shopping malls, office complexes, restaurants, hotels, motels, grocery stores, automobile service stations, petroleum distribution operations, dry cleaning operations, municipal yards, warehouses, law courts, museums, churches, golf courses, government offices, air and sea terminals, bus and railway stations, and storage associated with these uses.
- 1.1.1. Residential Land Use: the use of land for the primary purpose of (a) a residence by persons on a permanent, temporary or seasonal basis, including, without limitation, single family dwellings, cabins, apartments, condominiums or townhouses, or (b) institutional facilities, including, without limitation, schools, hospitals, daycare operations, prisons, correctional centres and community centres.
- 1.1.2. When referenced in the standards for levels of contamination, Commercial Land Use and Residential Land Use shall be defined as:
 - 1.1.2.1. Waste for soil or other material which does not exceed the applicable standard or guideline for Commercial Land Use and Residential Land Use.
 - 1.1.2.2. Waste Quality for soil or other material which does exceed the applicable standard or guideline for Commercial Land Use and Residential Land Use but is not Hazardous Waste.
- 1.1.3. Confirmation Samples: soil samples collected from the base and walls of the excavation by the Departmental Representative to confirm that the remedial objectives for the Work have been met.
- 1.1.4. Contaminated Waste: soil or other material where substances occur at concentrations that: (i) are above background levels and pose, or are likely to pose, an immediate or long-term hazard to human health or the environment, or (ii) exceed the levels specified in policies and regulations. Includes Hazardous Waste and Waste Quality; does not include Waste. Relevant regulations, unless otherwise in accordance with the Contract or as instructed by the Departmental Representative, include:
 - 1.1.4.1. For all sites: Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines*; CCME *Canada-Wide Standards*.
 - 1.1.4.2. For sites in British Columbia: *British Columbia Hazardous Waste Regulation*; *British Columbia Contaminated Sites Regulation*.
 - 1.1.4.3. For sites in Yukon: *YT Special Waste Regulation*; *YT Contaminated Sites Regulation*.
- 1.1.5. Contaminated Wastewater: liquid material where substances occur at concentrations that: (i) are above background levels and pose, or are likely to pose, an immediate or long-term hazard to human health or the environment, or (ii) meet or exceed the levels specified in policies and regulations. Includes Hazardous Waste; does not include Sewage Wastewater. Relevant regulations, unless otherwise in accordance with the Contract or as instructed by the Departmental Representative, include:
 - 1.1.5.1. For all sites: Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines*; CCME *Canada-Wide Standards*.
 - 1.1.5.2. For sites in British Columbia: *British Columbia Hazardous Waste Regulation*; *British Columbia Contaminated Sites Regulation*; *British Columbia Approved Water Quality Guidelines*.

- 1.1.5.3. For sites in Yukon: *Yukon Special Waste Regulation; Yukon Contaminated Sites Regulation.*
- 1.1.6. Contaminated Wastewater Treatment Plant: a temporary onsite or existing offsite facility located in Canada that is designed, constructed and operated for the handling or processing of Contaminated Wastewater in such a manner as to change the physical, chemical or biological character or composition of the water to lower than the site-specific remedial objective, Discharge Approval, and in compliance with all regulations.
- 1.1.7. Discharge Approval: permit, certificate, approval, or any other form of authorization issued by appropriate federal agency, province, territory, or municipality having jurisdiction and authorizing discharge into a waterway.
- 1.1.8. Disposal Facility: an existing offsite facility located in Canada where waste is placed in or on land and that is designed, constructed and operated to prevent any pollution from being caused by the facility outside the area of the facility. The facility must hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of soil, sediment, general refuse, construction/demolition waste or other material requiring disposal.
- 1.1.9. 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 humankind; or degrade environment aesthetically, culturally and/or historically.
- 1.1.10. Environmental Protection: prevention, control, mitigation, and restoration of pollution and habitat or environmental disruption during construction. Control of Environmental Pollution and Damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; vibrations; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- 1.1.11. Environmental Protection Plan: plan developed by the Contractor to ensure Environmental Protection and prevent Environmental Pollution and Damage identifying all environmental risks and mitigation measures, including: personnel requirements, emergency contacts, Environmental Protection methods, procedures, and equipment, and emergency response including a Spill Control Plan.
- 1.1.12. Hazardous Waste: Contaminated Waste which meets the regulatory definition of Hazardous Waste. Includes:
- 1.1.12.1. Hazardous Waste-comingled: Hazardous Waste which contains some contaminants which are amenable to treatment and some that are not.
- 1.1.12.2. Hazardous Waste-nontreatable: Hazardous Waste which contains only contaminants which are not amenable to treatment.
- 1.1.12.3. Hazardous Waste-treatable: Hazardous Waste which contains only contaminants which are amenable to treatment.
- 1.1.13. Land Surveyor: a person working for the Contractor who is a qualified, registered land surveyor licensed to practice in relevant jurisdiction.
- 1.1.14. Landfill: an existing offsite facility located in Canada where waste is placed in or on land and that is designed, constructed and operated to prevent any pollution from being caused by the facility outside the area of the facility. The facility must hold a

- valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of waste.
- 1.1.15. Materials Source Separation Program: consists of a series of ongoing activities to separate reusable and recyclable waste into categories from other types of waste at point of generation.
- 1.1.16. Overburden: non-contaminated soil excavated incidentally that is not Topsoil.
- 1.1.17. Qualified Professional: a person working for the Contractor who is registered in relevant jurisdiction with his or her appropriate professional association, acts under that professional association's code of ethics, and is subject to disciplinary action by that professional association, and through suitable education, experience, accreditation and knowledge can be reasonably relied on to provide advice within their area of expertise.
- 1.1.18. Relocation: consists of excavating, loading, transporting, unloading and placing soil or other material from one place on the Site to another.
- 1.1.19. Remediation by Excavation: excavation of Contaminated Waste and Waste to the Site boundaries, as instructed by the Departmental Representative, for the purpose of remediating the Site. Includes full treatment and disposal. Does not include risk assessment or risk management of material onsite. Does not include encapsulation or solidification in place.
- 1.1.20. Sewage Wastewater: liquid waste which is not suitable for direct discharge to the environment, and which must be either treated offsite or discharged to a sanitary sewer. Includes water from hand basin, shower, personal hygiene facilities, or other liquid waste from sanitary facilities.
- 1.1.21. Submit/Submittals: documents from the Contractor to the Departmental Representative as: required by Contract; stipulated in permit, certificate, approval, or any other form of authorization; by convention or industry practice. Submittals are final only after review and accepted in writing by Departmental Representative.
- 1.1.22. Topsoil: non-contaminated soil excavated incidentally that is a surface organic layer to facilitate vegetation growth.
- 1.1.23. Treatment Facility: an existing offsite facility located in Canada designed, constructed and operated for the handling or processing of waste in such a manner as to change the physical, chemical or biological character or composition of the waste. The facility must hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the treatment of soil, sediment, general refuse, construction/demolition waste or other material requiring treatment.
- 1.1.24. Non-Contaminated Waste: excess material generated by the Work which is not re-used onsite and is not Hazardous Waste or Contaminated Waste. Includes cleared and grubbed vegetation, litter, rubbish, debris, cobbles, boulders, excess construction material, lumber, steel, plastic, concrete, and asphalt. Includes surplus or unsuitable soil such as Topsoil or Overburden.
- 1.1.25. Waste Oversize Debris: Waste that is required to be excavated and is: larger than 2 cubic metres or larger than 2 metres in two dimensions, cannot be removed with a typical excavator, and requires the use of special equipment (e.g., saws, hydraulic cutters, excavator hammers, vibratory pile extractors).
- 1.1.26. Waste Quality: Contaminated Waste that does not meet the regulatory definition of Hazardous Waste. Includes:

- 1.1.26.1. Waste Quality-comingled: Waste Quality which contains some contaminants which are amenable to treatment and some that are not.
- 1.1.26.2. Waste Quality-nontreatable: Waste Quality which contains only contaminants which are not amenable to treatment.
- 1.1.26.3. Waste Quality-treatable: Waste Quality which contains only contaminants which are amenable to treatment.
- 1.1.27. Waste Reduction Plan: a written report which addresses opportunities for reduction, reuse or recycling of materials.
- 1.1.28. Wastewater: excess liquid material generated by the Work which are suitable for direct discharge to the environment after removal of sediment, and which is not Contaminated Wastewater or Sewage Wastewater. Includes surface runoff, stormwater, and groundwater which has not come into contact with Contaminated Waste.

1.2. Description of Work

- 1.2.1. The following describes the Remediation Work to be completed as part of the Contract.
 - 1.2.1.1. Remediation is required to remove a portion of the worst case residual hydrocarbon contamination in soil (Waste Quality material exceeding Residential Land Use and/or Commercial Land Use standards / guidelines) that remains following operation of an in situ remediation system from 2006 to 2009. The extent of residual soil contamination was determined based on a post remedial drilling investigation completed in 2009. The extent of hydrocarbon contaminated soil has been subdivided into four Areas, as shown on the Drawing (SR-001).
 - 1.2.1.2. The Work herein is limited to remedial excavation of: 1) Area 1, comprising more shallow source area Contaminated Waste soil extending west from approximately 1.5 m depth adjacent to the eastern ditch to beneath and south of the existing Generator Building at depths ranging from 4 m to 6 m; and 2) Area 2, comprising deeper soils extending from 4 m to greater than 6 m depth to the south of the Generator Building below House #9. Removal and appropriate sloping of significant overburden materials will be required to access the contaminated soil and the removal of Area 2 will proceed westward to the extent possible without requiring removal of Haines Highway. Haines Highway is located on provincial land under the jurisdiction of BC Ministry of Transportation and Infrastructure (MoTI) and is maintained by the Yukon Government Department of Highways and Public Works.
The remediation of Contaminated Waste soil in Areas 1 and 2 will proceed up to a maximum budget determined by Federal Contaminated Sites Action Plan (FCSAP) funding. As such, it is required that the Work be sequenced in order of Area 1 (source area Contaminated Waste soil) followed by Area 2 up to the maximum FCSAP budget.
 - 1.2.1.3. Based on availability of FCSAP funding, as an optional task, the Work may proceed to remediation of Areas 3 followed by portions of Area 4 comprising deeper Contaminated Waste soil extending from 6 m to 8 m depth under Haines Highway and south of House #9.
 - 1.2.1.4. The Work includes transport of all Contaminated Waste soil to an offsite permitted Treatment Facility or Landfill located in Canada or the United States.

- 1.2.1.5. The Contaminated Waste soil is located within the water table ranging from approximately 3 m to 8 m depth and follows the bedrock surface which slopes to the southwest/southeast. A combination of dewatering and wet excavation techniques will likely be required to successfully remove the Contaminated Waste soil. Contaminated Wastewater removed during the Work shall be treated in a temporary onsite or existing offsite Contaminated Wastewater Treatment Facility.
- 1.2.1.6. Imported fill material will be required to backfill the remedial excavation in the vicinity of future buildings, roadways and other structures proposed within the excavation footprint. Any excess overburden soils may be relocated onsite or removed offsite as non-Contaminated Waste.
- 1.2.2. Work to be performed under the Contract specific to Remediation includes, but is not limited to, the following items:
 - 1.2.2.1. Prime Contractor for health and safety and environmental protection at Site.
 - 1.2.2.2. All required design activities to complete Work.
 - 1.2.2.3. Pre-mobilization Submittals.
 - 1.2.2.4. Mobilization and Demobilization of all equipment personnel and materials.
 - 1.2.2.5. Preparation of the Site for Work, including decommissioning of monitoring wells within the excavation area, provision and installation of onsite temporary office facilities for Departmental Representative and consultants.
 - 1.2.2.6. Provision and installation of temporary fencing around the remedial excavation / work areas.
 - 1.2.2.7. Excavation planning, including geotechnical design and temporary support structures as required.
 - 1.2.2.8. Provision of equipment and personnel necessary for dewatering operations. Contaminated Wastewater generated from dewatering operations will be treated either onsite or transported to an offsite Treatment Plant as required.
 - 1.2.2.9. Excavate Overburden and Non-Contaminated Waste soil and stockpile temporarily onsite as instructed by the Departmental Representative.
 - 1.2.2.10. Excavate Contaminated Waste soil as in accordance with the Contract and as instructed by the Departmental Representative. Stockpile temporarily onsite for sampling.
 - 1.2.2.11. Backfilling of remedial excavation with clean imported fill or non-contaminated overburden fill material, as specified in Division Number 31 23 33.01, Part 2.1.
 - 1.2.2.12. Load, haul, and deposit Non-Contaminated Waste to a Landfill or other suitable location as instructed by the Departmental Representative.
 - 1.2.2.13. Load, haul, and deposit Contaminated Waste soil to a permitted Disposal Facility or Treatment Facility as approved by the Departmental Representative.
 - 1.2.2.14. Reinststate disturbed sections of Haines Highway in accordance with BC MoTI or Yukon Department of Highways and Public Works specifications, if required for Area 3 remediation.
 - 1.2.2.15. Restore and close Site.
 - 1.2.2.16. Prepare as-built and closure Submittals.
 - 1.2.2.17. All ancillary activities required to complete Work.

1.3. Measurement Procedures

- 1.3.1. Site Fencing will be paid in accordance with unit rate prove established to provide, erect, maintain, and demobilize materials and supplies.

- 1.3.2. Dewatering Equipment Provision will be paid in accordance with lump sum price established to provide all pumps, hoses, lines and tank(s) as necessary to dewater the excavation and store wastewater for disposal. Includes the provision of wastewater treatment equipment and facilities if wastewater treatment is undertaken onsite.
- 1.3.3. Dewatering Equipment Operation will be paid in accordance with a daily price to operate and maintain the equipment established to manage the volume of wastewater collected during dewatering of the excavation. This item also includes storage, transport and disposal of the collected water to an offsite Disposal Facility, and/or the operation and maintenance of any onsite wastewater treatment equipment and facilities provided.
- 1.3.4. Standby Time will be paid in accordance with unit rate price established for time when construction Work is unable to proceed due to non-specified delays caused solely by the Departmental Representative. Reviews, sampling, or other work conducted by Departmental Representative which have a time duration identified will not result in an increase in either the Contract price or the Contract time. Includes machinery and labour standby costs. Standby Time may be pro-rated based on hours of work. Does not include items covered by Site Facilities Operation.
- 1.3.5. Site Preparation will be paid in accordance with lump sum price established to prepare the Site for planned construction works, including any removal of trees, clearing and grubbing, utility location, rerouting, and protection. Also includes decommissioning of monitoring wells within the excavation area and removal of any incidental of generated material.
- 1.3.6. Site Closure will be paid in accordance with the lump sum price established to restore the Site to make suitable for post-remediation use. Includes removal of any incidental or generated material.

1.4. Action and Informational Submittals

- 1.4.1. Permits: at least 10 Working Days prior to mobilization to Site, Submit copies of all permits, certificates, approvals, or any other form of authorizations and all reporting required.
- 1.4.2. Work Sequencing: within 10 Working Days of Contract award and prior to mobilization to Site, Submit Work sequencing description and schedule. Includes:
 - 1.4.2.1. Describe sequence, methods and means to perform each major task.
 - 1.4.2.1.1. Major tasks include, as appropriate: pre-mobilization Work, Mobilization, Site Preparation, dates of Submittals including shop drawings, product data, MSDS sheets and samples, Dates of inspection and testing, installation of temporary facilities, excavation in each area, dewatering, backfilling, offsite transportation, offsite treatment, offsite disposal, Site Restoration and Demobilization, Final Completion date within the time period in accordance with the Contract, including Amendments.
 - 1.4.2.2. Show on a Gantt chart:
 - 1.4.2.2.1. Dates of commencement and completion of Work for each Description of Work identified on the Unit Price Table,
 - 1.4.2.2.2. Start, end and dependencies of each major task and Work to be performed in sequence and in parallel.
 - 1.4.2.2.3. Dates of Submittals including shop drawings, product data, MSDS sheets and samples.

- 1.4.2.2.4. Dates of inspection and testing.
- 1.4.2.2.5. Final Completion date within the time period in accordance with the Contract, including Amendments.
- 1.4.3. Site Preparation, Operation, and Restoration Plan: within 10 Working Days after Contract award and prior to mobilization to Site, Submit documentation describing excavation Work. Include:
 - 1.4.3.1. Site preparation design.
 - 1.4.3.2. Site security measures and location of fencing and gates.
 - 1.4.3.3. Paving design and areas to be paved.
 - 1.4.3.4. Onsite access roads design.
 - 1.4.3.5. Site restoration features and locations.
- 1.4.4. Import Fill Material Quality: at least 5 Working Days prior to bringing material onsite, Submit documentation signed and sealed by a Qualified Professional verifying that material is acceptable for import and intended use, and meets or exceeds requirements in accordance with the Contract and any other codes, bylaws, rules and regulations applicable to the performance of the Work. Include:
 - 1.4.4.1. Source, including supplier, location, and a Site Profile as specified in the British Columbia *Contaminated Sites Regulation*.
 - 1.4.4.2. Organic content information.
 - 1.4.4.3. Physical and geotechnical information.
 - 1.4.4.4. Sieve analytical results for grain-size distribution.
 - 1.4.4.5. Chemical analytical results, including: CCME BTEX/F1, CCME hydrocarbons F2-F4; extractable petroleum hydrocarbons; polycyclic aromatic hydrocarbons (PAHs); total metals, and suitable tests confirming Acid Rock Drainage and Metals Leaching potential.
 - 1.4.4.6. Testing to be performed and reported by an accredited laboratory and reported at sufficient frequency to characterize all material imported to Site. Test using appropriate guidelines and practices.
 - 1.4.4.7. Submit samples representative of all material to be imported. Sample frequency subject to acceptance by Departmental Representative.
 - 1.4.4.8. Submit sufficient sample size to allow geotechnical and environmental quality testing.
 - 1.4.4.9. Perform additional as required by Departmental Representative.
 - 1.4.4.10. Facilitate testing by Departmental Representative.
- 1.4.5. Schedule of Interruption of Services: No interruption of services is permitted at the Site (active border crossing). If an interruption to services is necessary the Departmental Representative must be notified.
- 1.4.6. Utility Locations: at least 5 Working Days prior to commencing any subsurface disturbance, Submit drawings identifying all utilities on the Site. Update drawings as instructed by the Departmental Representative.
- 1.4.7. Breakdown of Lump Sum Prices: at least 5 Working Days prior to submitting the first Progress Payment, Submit a breakdown of the Contract lump sum prices including labour, material and time, in detail as instructed by the Departmental Representative and aggregating Contract Amount.
- 1.4.8. Daily Work Records: at the end of each shift Submit daily Work records, during onsite Work. Include:

- 1.4.8.1. Quantities for each Description of Work identified in the Unit Price Table and Change Orders.
- 1.4.8.2. Description of Work performed.
- 1.4.8.3. Current Site conditions.
- 1.4.8.4. General information including: date, time shift started and ended, Subcontractor(s) onsite, Health and Safety items, and Environmental Protection items.
- 1.4.8.5. Signature of Superintendent and Departmental Representative.
- 1.4.9. Coordination Meeting Minutes and Drawings: at least 5 Working Days prior to relevant Work commencing, Submit final meeting minutes and drawings from coordination with Subcontractors.
- 1.4.10. Quality Management Plan: within 10 Working Days after Contract award, Submit a quality management plan. Include:
 - 1.4.10.1. Details on planned review, inspection and testing to provide Quality Assurance and Quality Control for the Work.
 - 1.4.10.2. Subcontractors responsible for review, inspection and testing.
 - 1.4.10.3. Schedule of submittals of review, inspection and testing results.
- 1.4.11. Review, Inspection, and Testing Results: within 5 Working Days of receipt, submit all results of reviews, inspection, and testing performed as part of the Work, including laboratory reports.

1.5. Sequencing for Free Phase Products

- 1.5.1. If floating free phase substance is present, remove free phase from saturated soil or sediment without further contaminating soil, sediment or groundwater prior to commencing other construction Work.
- 1.5.2. Collect free phase product, load, and transport to a Treatment Facility.
- 1.5.3. Decontaminate equipment used in construction procedures before removing equipment from job site.

1.6. Access Road Maintenance

- 1.6.1. Maintain access roads including Haines Highway as follows:
 - 1.6.1.1. Obtain permission to use existing access roads.
 - 1.6.1.2. Maintain and clean roads for duration of Work.
 - 1.6.1.3. Control mud and dust from road.
 - 1.6.1.4. Repair damage incurred from use of roads.
 - 1.6.1.5. Provide photographic documentation of roads used by construction vehicles before, during and after Work.
 - 1.6.1.6. The Departmental Representative can instruct cleaning of the onsite and public access roads.

1.7. Existing Conditions

- 1.7.1. Buried services:
 - 1.7.1.1. Before commencing Work establish location of buried services on and adjacent to Site.
 - 1.7.1.2. Arrange with appropriate authority for relocation of buried services that interfere with execution of Work: pay costs of relocating services.
 - 1.7.1.3. Remove obsolete buried services within 2 m of foundations: cap cut-offs.

- 1.7.1.4. Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
- 1.7.1.5. Prior to beginning Work that may disrupt utilities, notify applicable Departmental Representative and authorities having jurisdiction and establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.
- 1.7.1.6. As appropriate, confirm locations of buried utilities by independent utility locator and hand test excavations and/or soil hydrovac methods.
- 1.7.1.7. Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
- 1.7.1.8. Record location of maintained, re-routed and abandoned underground lines. Registered surveyor to provide as-built drawings of all services to Departmental Representative.
- 1.7.1.9. Confirm locations of recent excavations adjacent to area of excavation.
- 1.7.2. Existing buildings and surface features:
 - 1.7.2.1. Conduct condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, roads, survey bench marks, monuments and other features which may be affected by Work.
 - 1.7.2.2. Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair.
 - 1.7.2.3. Where required for excavation, cut roots or branches.

2. PART 2 - PRODUCTS

2.1. Materials

- 2.1.1. Erosion and sediment control materials to meet or exceed the following requirements:
 - 2.1.1.1. Hay or Straw Bale: wire bound or string tied; securely anchored by at least 2 stakes or rebars driven through bale 300 mm to 450 mm into ground; chinked (filled by wedging) with hay or straw to prevent water from escaping between bales; and entrenched minimum of 100 mm into ground.
 - 2.1.1.2. Silt Fence: assembled, ready to install unit consisting of geotextile attached to driveable posts. Geotextile: uniform in texture and appearance, having no defects, flaws, or tears that would affect its physical properties; and contain sufficient ultraviolet ray inhibitor and stabilizers to provide minimum 2-year service life from outdoor exposure.
 - 2.1.1.3. Net Backing: industrial polypropylene mesh joined to geotextile at both top and bottom with double stitching of heavy-duty cord, with minimum width of 750 mm.
 - 2.1.1.4. Posts: sharpened wood, approximately 50 mm square, protruding below bottom of geotextile to allow minimum 450 mm embedment; post spacing 2.4 m maximum. Securely fasten each post to geotextile and net backing using suitable staples.
- 2.1.2. Import fill materials to meet or exceed the following minimum requirements:
 - 2.1.2.1. Originate from a clean source.
 - 2.1.2.2. Be free of organic material, including noxious weed seeds or reproductive plant parts. Noxious weeds are defined as non-native plants species listed in the British Columbia *Weed Control Act* or as instructed by the Departmental Representative.

- 2.1.2.3. Be granular aggregate composed of inert, clean, tough, durable particles of crushed rock, gravel and sand capable of withstanding the deleterious effects of exposure to water, freeze-thaw, handling, spreading and compacting. The aggregate particles must be uniform in quality and free from clay lumps, wood and free from an excess of flat or elongated pieces.
- 2.1.2.4. Have grain-size gradations to be within limits in accordance with the Contract or as instructed by the Departmental Representative when tested to ASTM C117-13 (*Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing*) and ASTM C136-06 (*Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates*). Sieve sizes to SCC CAN/CGSB-8.1-88 (*Sieves, Testing, Woven Wire, Inch Series*) and CAN/CGSB-8.2-M88 (*Sieves, Testing, Woven Wire, Metric Series*).
- 2.1.2.5. Be the lesser of the Canadian Council of Ministers of the Environment *Soil Quality Guidelines for Commercial and Residential Land Uses*, and the British Columbia *Contaminated Sites Regulation Schedule 7- Standards Triggering Contaminated Soil Relocation Agreements, Soil Relocation to Non-agricultural Land*.
- 2.1.2.6. Have an Acid Rock Drainage and Metals Leaching potential of Sulphide-S content < 0.3%; have a Paste pH > 5.5; and have a Neutralization Potential Ratio (Neutralization Potential/Acid Potential) > 2. Acid Rock Drainage and Metals Leaching potential to be tested using acid base accounting (ABA) for assessment of acid Rock Drainage potential and more specifically using the Modified Sobek Test Method. The potential for metals leaching must use Shake Flask Extraction (SFE) Method for analysis of metals leaching. See guidance document Price 2009, *Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials Mine Environment Neutral Drainage Report 1.20.1*, Natural Resources Canada.
- 2.1.2.7. Remove and replace import fill material, including relevant previously placed material, which has a discrete sample not in accordance with the Contract, as instructed by the Departmental Representative. Provide an alternate source of backfill, with no increases to Contract Amount or Extension of Time for completion of the Work.
- 2.1.3. Import fill material additional testing:
 - 2.1.3.1. Perform additional testing as instructed by the Departmental Representative.
 - 2.1.3.2. Facilitate testing by the Departmental Representative.
- 2.1.4. Pavement (if required for Haines Highway reinstatement)
 - 2.1.4.1. Meet or exceed asphalt specifications as per Yukon Department of Highways and Public Works, or BC Ministry of Transportation and Infrastructure requirements.

2.2. Equipment

- 2.2.1. Temporary barriers and enclosures as required.
- 2.2.2. Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.
- 2.2.3. Trucks:
 - 2.2.3.1. Cleaned meticulously between loads of contaminated soil and clean fill.
 - 2.2.3.2. Cleaned meticulously at end of work day.
 - 2.2.3.3. Cover truck bodies with tarpaulins during transportation.
 - 2.2.3.4. Use watertight truck bodies for transporting contaminated soil.
- 2.2.4. Safety equipment.

3. PART 3 - EXECUTION

3.1. Examination

3.1.1. Site Verification of Conditions:

- 3.1.1.1. Contractor to determine condition of existing Site and requirements to make the Site suitable for Work.

1.2. Mobilization Requirements

- 1.2.1. Do not mobilize until instructed by Departmental Representative.
- 1.2.2. Mobilize all necessary equipment, materials and personnel to the Site in an orderly and efficient manner.

1.3. Site Preparation and Operation

- 1.3.1. Site Preparation and operation includes construction, operation and maintenance for the duration of the Work,
- 1.3.2. Remove and dispose all surficial Non-Contaminated Waste at a Landfill to allow access for Work.
- 1.3.3. Clearing and grubbing of the Site to allow access for Work.
 - 1.3.3.1. Clearing consists of removing Non-Contaminated Waste vegetation above existing ground surface to facilitate Work. Includes: cutting off trees and brush vegetative growth, felled trees, previously uprooted trees and stumps. Dispose of Waste at a Landfill or reuse onsite as determined by Departmental Representative.
 - 1.3.3.2. Grubbing consists of excavation of Non-Contaminated Waste below existing ground surface to facilitate Work. Includes: stumps, roots, boulders and rock fragments. Dispose of Non-Contaminated Waste at a Landfill or reuse onsite as determined by Departmental Representative.
- 1.3.4. Construct, operate and maintain all infrastructure, including temporary structures and facilities, sanitary facilities, roadways, security, and services.
- 1.3.5. Remove obstructions, ice and snow, from surfaces to be worked.
- 1.3.6. Protection:
 - 1.3.6.1. Protect existing features with temporary barriers and enclosures as required by applicable local regulations.
 - 1.3.6.2. Keep excavations clean, free of standing water, and loose soil or sediment.
 - 1.3.6.3. Protect natural and man-made features required to remain undisturbed. Unless otherwise required or located in an area to be occupied by new construction, protect existing trees from damage.
 - 1.3.6.4. Protect buried utilities that are required to remain undisturbed.
 - 1.3.6.5. Protect existing monitoring wells such that they can be used for future monitoring of subsurface conditions.
 - 1.3.6.6. Manage recovered water according to contamination level and provincial/municipal/territory regulations.
 - 1.3.6.7. Provide temporary structures to divert flow of surface water from excavation.
- 1.3.7. Security and Safety:
 - 1.3.7.1. Provide safety measures to ensure worker and public safety.

- 1.3.7.2. Ensure Site is secure during onsite Work, provide, install, and remove fencing, temporary hoarding, and other security measures as required and specified.
- 1.3.7.3. Secure the Site with locked fencing, temporary hoarding and security personnel as appropriate, including all restoration and excavation areas.
- 1.3.8. Paving:
 - 1.3.8.1. Pave areas as required: to complete the Work; in accordance with the Contract; or as instructed by Departmental Representative.

1.4. Standby Time

- 1.4.1. Provide adequate advance notice to Departmental Representative that providing information or doing an act is required to avoid incurring Standby Time.
- 1.4.2. Make all efforts to minimize impacts due to delays caused by the Departmental Representative, including re-sequencing Work.
- 1.4.3. Provide documentation of a sufficient description of the facts and circumstances of the occurrence to enable the Departmental Representative to determine whether or not the Standby Time is justified.
- 1.4.4. Reviews, sampling, or other work conducted by the Departmental Representative with time allowances in accordance with the Contract will result in no increase to the Contract Amount nor Extension of Time for completion of the Work.

1.5. Design, Construction and Operation of Onsite Access Roads

- 1.5.1. Design of temporary onsite access roads to be signed and sealed by a Qualified Professional.
- 1.5.2. Qualified Professional to confirm that the temporary onsite access roads allow for the safe transport of materials and equipment.
- 1.5.3. Construct all temporary access, detour and haul roads to accommodate all required uses and be maintained throughout the course of construction operations in a safe, environmentally sound manner.
- 1.5.4. Location, alignment, design and construction of all detour, access and haul roads subject to the acceptance of the Departmental Representative.
- 1.5.5. Employ suitable measures to maintain quality, visibility, and safe conditions in the use of access, detour and haul roads associated with the Work.

1.6. Import Fill Material

- 1.6.1. Do not import fill material until Departmental Representative has reviewed all testing results provided by Contractor and agreed to allow the fill material to be imported.
- 1.6.2. Departmental Representative will inspect import fill material, and will not allow import of fill material that varies from Submittal samples.

1.7. Site Closure

- 1.7.1. Reinstall or replace all pre-Work structures, utilities, or other features: to the more stringent of pre-Work condition or current standards; in accordance with the Contract; or as instructed by the Departmental Representative.
- 1.7.2. Grade to within 5 cm of pre-existing grades before Work commenced or in accordance with the Contract.

- 1.7.3. Clean permanent access roads of contamination resulting from project activity as required or as instructed of Departmental Representative, with no increases to Contract Amount or Extension of Time for completion of the Work.
- 1.7.4. Decontaminate equipment used in construction processes and remove from Site at end of construction activities.
- 1.7.5. Remove all temporary structures including subsurface structures for shoring support.
- 1.7.6. Upon Final Completion of Work, remove Waste materials and debris, trim slopes, and correct defects as instructed by the Departmental Representative.
- 1.7.7. Protect newly graded areas from traffic and erosion and maintain free of trash or debris until demobilization is completed and accepted by the Departmental Representative.

1.8. Demobilization

- 1.8.1. Do not demobilize until instructed by Departmental Representative.
- 1.8.2. Demobilize all necessary equipment, materials, and personnel from Site in an orderly and efficient manner.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 33 - Health and Safety Requirements
- .3 Section 01 35 43 - Environmental Procedures
- .4 Section 01 74 11 - Cleaning
- .5 Section 01 74 21 - Demolition Waste Management and Disposal
- .6 Section 02 82 00.01 - Asbestos Abatement - Minimum Precautions
- .7 Section 02 82 00.02 - Asbestos Abatement - Intermediate Precautions
- .8 Section 02 82 00.03 - Asbestos Abatement - Maximum Precautions

1.2 REFERENCES

- .1 Reports
 - .1 Appendix B: “FY 2012/2013 Building Conditions Assessment – CBSA Port of Pleasant Camp Border Crossing, Pleasant Camp, BC”, prepared by SNC Lavalin Environment, dated March 31, 2013 (further referred to as the SNCL Report).
 - .2 Appendix C: “Hazardous Materials Assessment – Canada Border Services Agency – Pleasant Camp Port of Entry – Pleasant Camp, British Columbia”, prepared by Golder Associates, dated February 14, 2007 (further referred to as the Golder Report).
- .2 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.
- .3 Reference Standards:
 - .1 Canadian Environmental Protection Act, 1999 (CEPA 1999)
 - .1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
 - .2 Department of Justice Canada (Jus)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).

- .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Research Council Canada Institute for Research in Construction (NRC-IRC)
 - .1 National Fire Code of Canada-[2005].
- .5 WorkSafe BC
 - .1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)
 - .2 "Safe Work Practices for Handling Asbestos" (2012 Edition)
 - .3 "Lead-Containing Paints and Coatings; Preventing Exposure in the Construction Industry", 2011
- .6 The current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88)
- .7 The Federal Transportation of Dangerous Goods Regulation
- .8 The Federal PCB Regulations (SOR/2008-273).
- .9 The British Columbia Waste Management Act - Ozone Depleting Substances and Other Halocarbons Regulation (BC Reg. 387/99).
- .10 The Federal Halocarbons Regulation, July 2003

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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 MSDS in accordance with Sections 01 35 33 - Health and Safety Requirements and 01 35 43 - Environmental Procedures 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.
 - .4 Construction Waste Management:
 - .1 Submit project Demolition Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating percentage of construction wastes were recycled or salvaged
 - .5 Low-Emitting Materials: submit listing of adhesives and sealants used in building, comply with VOC and chemical component limits or restrictions requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance 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 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .4 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:
 - .1 Co-ordinate transportation and disposal with Departmental Representative.
 - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Only trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.
 - .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
- .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 and Consultant. Submit a written spill report to Departmental Representative within 24 hours of incident.
- .5 Develop Demolition Waste Management Plan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 Description:
 - .1 Bring on site only quantities hazardous material required to perform Work.
 - .2 Maintain MSDS 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 HAZARDOUS MATERIALS ABATEMENT

- .1 Scope of Abatement Activities (other than Asbestos – specified elsewhere) for the Garage, Generator Building and House #9.
 - .1 Abatement shall be conducted to remove and dispose of hazardous building materials as identified in the SNCL Report and Golder Report in accordance with applicable regulations, guidelines, standards and/or best practices for such work.
 - .2 The listing below is a summary of the identified hazardous building materials (other than asbestos) and associated removal and disposal regulations, guidelines and/or standards.
 - .3 Note: The Garage is referred to as the “Customs Office Garage” in the Golder Report
 - .4 Note: House #9 is referred to as “House #5” in the Golder Report.

Lead

Demolition to be conducted in accordance with the requirements of the current version of the WorkSafe BC publication “Lead-Containing Paint and Coatings: Preventing Exposure in the Construction Industry”, keeping airborne exposure to lead dust to less than the 8-hour Occupational Exposure Limit (OEL) for lead of 0.05 milligram per cubic metre (mg/m³).

Waste transportation to be conducted in accordance the Federal Transportation of Dangerous Goods Regulation.

Waste disposal to be conducted in accordance with the current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88). If the Contractor chooses to dispose of identified lead-containing materials or materials with identified lead-containing paints via landfill in BC, the Contractor will be responsible for applicable leachate testing of waste materials to determine landfill options.

Lead-containing materials to be considered during demolition are summarized below. Where discrepancies exist between the listing below and the SNCL Report or the Golder Report, the information listed in the SNCL Report and/or the Golder Report will prevail:

1. Garage:
 1. Per the Golder Report: Exterior black paint on door, window trim and garage door (one of two samples). NOTE: Similar paint was tested per the SNCL report and found NOT to be lead-containing (one sample total).
2. Generator Building:
 1. Per the SNCL Report: Black paint on exterior doors, trim and south side vents
 2. Per the SNCL Report: tan paint on drywall behind insulation panels (Old Area – walls and ceilings)
 3. Per the Golder Report: orange, dark green, green and red paints on the generators and pumps
 4. Per the SNCL Report: Four lead-containing batteries (indicated as six batteries in the Golder Report, however, given the report dates, it appears as though two were removed).

3. House #9:
 1. Per the SNCL Report: Black paint on exterior trim
 2. Per the SNCL Report: Grey paint on exterior wooden steps (northeast and northwest corners of building)
 3. Per the SNCL Report: White paint on interior walls (dining room)
 4. Per the SNCL Report and the Golder Report: White paint on exterior wooden surfaces (north side of building)
 5. Per the SNCL Report and the Golder Report: grey paint on concrete floor (same as stairs to basement)
 6. Per the SNCL Report: Potential lead-containing pipe joints and lead vent stacks (on the roof, which was inaccessible)
4. Lead is also expected to be present in the solder used on copper domestic pipes, is likely present in the caulking on bell fittings for cast iron drainage pipes, and is expected to be present in electrical equipment (i.e., batteries for emergency lighting/signage).

Polychlorinated Biphenyls (PCBs)

For the fluorescent light fixtures within the Garage, Generator Building and House #9 :

1. Remove all fluorescent lamp fixtures. Assess all ballasts in comparison to the Environment Canada document entitled “Identification of Lamp Ballasts Containing PCBs, Report EPS 2/CC/2”, dated August 1991 (or equivalent reference).
2. Sort PCB-containing lamp ballasts from non-PCB-containing lamp ballasts.

Waste transportation to be conducted in accordance the Federal Transportation of Dangerous Goods Regulation.

Dispose of ballasts in accordance with the current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88) and The Federal PCB Regulations (SOR/2008-273).

Mercury

Remove all thermostats with mercury-containing switches, fluorescent light tubes and high intensity discharge lights (mercury vapour) and/or other mercury-containing items.

Waste transportation to be conducted in accordance with the Federal Transportation of Dangerous Goods Regulation.

Dispose of waste in accordance with the current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88).

With respect to thermostat switches, remove and dispose of the following:

1. Generator Building: Two (2) thermostats (centre thermostat on west wall and south-most thermostat on east wall)
2. House #9 (basement): One thermostat (north side of staircase near furnace)
3. House #9 (main floor – hall): One thermostat (west wall of the hallway, outside of kitchen and next to bedroom #2)

Ozone-Depleting Substances (ODSs)

ODSs within equipment to be drained and recaptured by licensed technicians in accordance with the Federal Halocarbons Regulations, complete with appropriate support documentation to be provided to the Consultant.

Waste transportation to be conducted in accordance the Federal Transportation of Dangerous Goods Regulation.

Waste disposal to be conducted in accordance with the British Columbia Waste Management Act - Ozone Depleting Substances and Other Halocarbons Regulation (BC Reg. 387/99).

Remove and dispose of the following ODS-containing / refrigerant-containing equipment:

4. House #9 (basement) – One (1) freezer – Model GU17L (Electrolux), Serial # KJ10424, Refrigerant – 10oz of CFC 12 – Dichlorodifluoromethane (R12)
5. House #9 (kitchen) – One (1) refrigerator – Model GR9FHKXPQ00 (Whirlpool), Serial # ES4533118, Refrigerant – 4oz of R134a
6. House #9 – One (1) water cooler – Model D25 (Whirlpool), Serial # EJY481815, Refrigerant – 1.07oz of R134a

Silica

Silica may be present in concrete, cement, mortar, ceramic wall and floor tiles, stucco finishes and acoustic tiles, which are present in various locations throughout.

When silica-containing materials are to be removed during demolition activities, ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by BC Reg. 296/97 (0.025 mg/m³). This would include, but not be limited to, the following:

1. Providing workers with respiratory protection
2. Wetting the surface of the materials to prevent dust emissions
3. Providing workers with facilities to properly wash prior to exiting the work area
4. Providing dust control to mitigate the potential for demolition dust to escape from the work area into public and/or adjacent areas

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning. 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 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Demolition Waste Management and Disposal.
 - .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 federal and 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 OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Refer to following reports attached in Appendices, for information pertaining to the asbestos-containing materials (ACMs) that have been identified in structures to be demolished (the Garage, the Generator Building and House #9).
 - .1 Appendix B: “FY 2012/2013 Building Conditions Assessment – CBSA Port of Pleasant Camp Border Crossing, Pleasant Camp, BC”, prepared by SNC Lavalin Environment, dated March 31, 2013 (further referred to as the SNCL Report).
 - .2 Appendix C: “Hazardous Materials Assessment – Canada Border Services Agency – Pleasant Camp Port of Entry – Pleasant Camp, British Columbia”, prepared by Golder Associates, dated February 14, 2007 (further referred to as the Golder Report).
 - .1 Note: The Garage is referred to as the “Customs Office Garage” in the Golder Report
 - .2 Note: House #9 is referred to as “House #5” in the Golder Report.
- .2 Unless otherwise determined through risk assessment conducted by a qualified person, comply with requirements of this Section when performing following Work:
 - .1 Installing enclosures and/or conducting set-up activities for asbestos abatement work covered under Section 02 82 00.02 – Asbestos Abatement Intermediate Precautions and Section 02 82 00.03 – Asbestos Abatement Maximum Precautions.
 - .2 Removing and disposing of the following identified ACMS:
 - .1 Generator Building:
 - .1 SNCL Report: Grey putty filling exterior holes in siding/walls (7 locations – 3 on north side, 2 on east side, 2 on south side)
 - .2 SNCL Report: Black mastic (on metal roof of the “Old Area”)
 - .3 SNCL Report: Black mastic joining the exterior metal cladding pipe cover to the Water Storage Tank
 - .4 SNCL Report: Grey mastic joining the exterior metal cladding pipe cover to the Generator Building
 - .5 SNCL Report: Black shingles beneath the metal cladding on the ground pipe cover from the Water Storage Tank to the Generator Building
 - .6 SNCL Report: Dark grey pipe gaskets in the Fire Suppression System (approximately 7 gaskets), if removed in-tact
 - .7 Golder Report: Grey gasket material on the generators (if removed in-tact)
 - .2 House #9
 - .1 SNCL Report: Grey mastic/putty around 3 electrical boxes (2 on east side, 1 on west side), in 1 hole on the east side and surrounding the chimney flashing on the roof

- .2 Golder Report: Grey and white mastic around pipe penetrations on the exterior
- .3 SNCL Report: Potential asbestos-containing pipe joints and electrical wiring coatings throughout

1.2 SECTION INCLUDES

- .1 Requirements and procedures for applicable procedures and personal protective equipment to be utilized during set-up of asbestos abatement work areas and for abatement of ACMs of the type described within.

1.3 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 33 - Health and Safety Requirements
- .3 Section 01 74 21 - Demolition Waste Management and Disposal
- .4 Section 02 82 00.02 – Asbestos Abatement Intermediate Precautions
- .5 Section 02 82 00.03 – Asbestos Abatement Maximum Precautions.

1.4 REFERENCES

- .1 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .4 Underwriters' Laboratories of Canada (ULC)
- .5 WorkSafe BC
 - .1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)
 - .2 "Safe Work Practices for Handling Asbestos" (2012 Edition)
- .6 The current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88)

1.5 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 non-ionic 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 (or vermiculite insulation materials with any asbestos) 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: Consultant or Departmental Representative and representatives of regulatory agencies.
- .6 Competent worker: 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.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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.
- .3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 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.

- .6 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.
- .7 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.

1.7 **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 Perform construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
 - .2 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. Facilities for washing are to be supplied by the Contractor.
- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Demolition Waste Management and Disposal
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate and place in designated containers steel metal plastic waste 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 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.

1.9 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMs to be handled, removed, or otherwise disturbed and disposed of during this project are bound into this specification in **Appendix B and C**.

- .2 Notify Departmental Representative of additional suspected ACMs discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

1.10 SCHEDULING

- .1 Hours of Work: perform work during normal working hours.

1.11 OWNER'S 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 Do construction occupational health and safety in accordance Section 01 35 33 - Health and Safety Requirements.
- .2 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.
- .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 Asbestos Work Area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.
- .4 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.
- .5 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.
- .6 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 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Contractor to take air samples inside and outside of Asbestos Work Area enclosure[s] in accordance with British Columbia’s Occupational Health and Safety Regulation and the current version of the WorkSafeBC Manual entitled “Safe Work Practices for Handling Asbestos”.
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
 - .2 If air monitoring shows that areas outside Asbestos Work Area enclosure[s] are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area, at no additional cost to the Owner.
 - .3 Ensure that respiratory safety factors are not exceeded.
 - .4 During the course of Work, Contractor to measure fibre content of air outside Work areas by means of air samples analyzed by Phase Contrast Microscopy (PCM).
 - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Refer to following reports attached in the Appendices, for information pertaining to the asbestos-containing materials (ACMs) that have been identified in structures to be demolished (the Garage, the Generator Building and House #9).
 - .1 Appendix B: “FY 2012/2013 Building Conditions Assessment – CBSA Port of Pleasant Camp Border Crossing, Pleasant Camp, BC”, prepared by SNC Lavalin Environment, dated March 31, 2013 (further referred to as the SNCL Report).
 - .2 Appendix C: “Hazardous Materials Assessment – Canada Border Services Agency – Pleasant Camp Port of Entry – Pleasant Camp, British Columbia”, prepared by Golder Associates, dated February 14, 2007 (further referred to as the Golder Report).
 - .1 Note: The Garage is referred to as the “Customs Office Garage” in the Golder Report
 - .2 Note: House #9 is referred to as “House #5” in the Golder Report.
- .2 Unless otherwise determined through risk assessment conducted by a qualified person, comply with requirements of this Section when performing following Work:
 - .1 Removing and disposing of the following ACMs:
 - .1 Generator Building
 - .1 SNCL Report: Drywall joint compound within the “Old Area”
 - .2 SNCL Report: Dark grey pipe gaskets in the Fire Suppression System (approximately 7 gaskets), if removed using Glove Bag or other procedures
 - .3 Golder Report: Grey gasket material on the generators (if removed using Glove Bag or other procedures)
 - .2 House #9
 - .1 SNCL Report and Golder Report: Yellow/tan vinyl sheet flooring in the kitchen (above orange/brown vinyl floor tiles), main floor bathroom (middle layer of flooring) front foyer (under laminate flooring), bedroom #2 and rear mudroom, **if removal is conducted by removing material with sub-floor (and underlying layers) in-tact**

1.2 SECTION INCLUDES

- .1 Requirements and procedures for asbestos abatement of asbestos containing materials of the type described within.

1.3 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 33 - Health and Safety Requirements

- .3 Section 01 74 21 - Demolition Waste Management and Disposal
- .4 Section 02 82 00.01 – Asbestos Abatement Minimum Precautions
- .5 Section 02 82 00.03 – Asbestos Abatement Maximum Precautions

1.4 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.205-[94], 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 Material Safety Data Sheets (MSDS).
- .4 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 Underwriters' Laboratories of Canada (ULC)
- .6 WorkSafe BC
 - .1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)
 - .2 "Safe Work Practices for Handling Asbestos" (2012 Edition)
- .7 The current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88)

1.5 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 (or vermiculite insulation materials with any asbestos) 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, and representatives of regulatory agencies.
- .5 Competent worker: 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 Glove Bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
 - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
 - .4 Straps for sealing ends around pipe.
- .8 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.
- .9 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .10 Occupied Area: any area of building or work site that is outside Asbestos Work Area.
- .11 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.
- .12 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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.
- .3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 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.
- .6 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.

- .7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration. Minimum of one supervisor for every ten workers.
- .8 Submit Worker's Compensation Board status and transcription of insurance.
- .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) 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. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

1.7 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 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
 - .2 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
 - .1 Full-facepiece powered, 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.
- .4 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.
- .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.
- .7 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.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal 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 steel, metal, and/or plastic waste 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 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 licenced landfill for burial.

1.9 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification in **Appendix B and C**.
- .2 Notify Departmental Representative of additional suspected ACM discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.10 SCHEDULING

- .1 Hours of Work: perform work during normal working hours.

1.11 OWNER'S 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, in use of 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 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 or where glove bag method is used, glove bag itself.
- .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 Glove bag:
 - .1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.
 - .2 The glove bag to be equipped with:
 - .1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.
 - .2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
 - .3 A tool pouch with a drain.
 - .4 A seamless bottom and a means of sealing off the lower portion of the bag.
 - .5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.
- .5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .6 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.
- .7 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 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

- .2 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)'.
- .3 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.
- .4 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.
- .5 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.
- .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.

3.3 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Contractor to take air samples inside and outside of Asbestos Work Area enclosure[s] in accordance with British Columbia's Occupational Health and Safety Regulation and the current version of the WorkSafeBC Manual entitled "Safe Work Practices for Handling Asbestos".
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .2 If air monitoring shows that areas outside Asbestos Work Area enclosure[s] are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area, at no additional cost to the Owner.
- .3 Ensure that respiratory safety factors are not exceeded.
- .4 During the course of Work, Contractor to measure fibre content of air outside Work areas by means of air samples analyzed by Phase Contrast Microscopy (PCM).
 - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.
- .5 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Contractor will perform 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, at no cost to Owner.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Refer to following reports attached in Appendices B and C, for information pertaining to the asbestos-containing materials (ACMs) that have been identified in structures to be demolished (the Garage, the Generator Building and House #9).
 - .1 Appendix B: “FY 2012/2013 Building Conditions Assessment – CBSA Port of Pleasant Camp Border Crossing, Pleasant Camp, BC”, prepared by SNC Lavalin Environment, dated March 31, 2013 (further referred to as the SNCL Report).
 - .2 Appendix C: “Hazardous Materials Assessment – Canada Border Services Agency – Pleasant Camp Port of Entry – Pleasant Camp, British Columbia”, prepared by Golder Associates, dated February 14, 2007 (further referred to as the Golder Report).
 - .1 Note: The Garage is referred to as the “Customs Office Garage” in the Golder Report
 - .2 House #9 is referred to as “House #5” in the Golder Report
- .2 Unless otherwise determined through risk assessment conducted by a qualified person, comply with requirements of this Section when performing following Work:
 - .1 Removing and disposing of the following ACMs
 - .1 House #9
 - .1 SNCL Report and Golder Report: Yellow/tan vinyl sheet flooring in the kitchen (above orange/brown vinyl floor tiles), main floor bathroom (middle layer of flooring) front foyer (under laminate flooring), bedroom #2 and rear mudroom, **if removal is conducted by removing material from sub-floor and/or underlying layers**

1.2 SECTION INCLUDES

- .1 Requirements and procedures for asbestos abatement of asbestos containing materials of the type described within.

1.3 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 33 - Health and Safety Requirements
- .3 Section 01 74 21 - Demolition Waste Management and Disposal
- .4 Section 02 82 00.01 – Asbestos Abatement Minimum Precautions
- .5 Section 02 82 00.02 – Asbestos Abatement Intermediate Precautions

1.4 REFERENCES

- .1 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.205-[94], Sealer for Application to Asbestos-Fibre-Releasing Materials.
- .2 Department of Justice Canada
 - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 Underwriters' Laboratories of Canada (ULC)
- .6 WorkSafe BC
 - .1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)
 - .2 "Safe Work Practices for Handling Asbestos" (2012 Edition)
- .7 The current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88)
- .8 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)
 - .1 NIOSH 94-113-[August 1994], NIOSH Manual of Analytical Methods (NMAM), 4th Edition.
- .9 U.S. Department of Labour - Occupational Safety and Health Administration - Toxic and Hazardous Substances
 - .1 29 CFR 1910.1001-[2001], Asbestos Regulations.

1.5 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 (or vermiculite insulation materials with any asbestos) 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 Representative, Consultant, and representatives of regulatory agencies.
- .6 Competent worker: in relation to specific work, means a worker who:
 - .1 Is qualified because of knowledge, training and experience to perform the work.

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- .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 1.5 m on each side.
 - .8 DOP Test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (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 Glove Bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
 - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
 - .4 Straps for sealing ends around pipe.
 - .11 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.
 - .12 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.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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. 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 Worker's Compensation Board status and transcription of insurance.
 - .10 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including but not limited to following:
 - .1 Encapsulants.
 - .2 Amended water.
 - .3 Slow drying sealer.

1.7 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:

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- .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
 - .2 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:
 - .1 Powered air purifying respirator (PAPR) 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.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal 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 steel, metal, and plastic waste 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 6mil 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 licenced landfill for burial.

1.9 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification in **Appendix B and C**.
- .2 Notify Departmental Representative of suspect asbestos containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.10 SCHEDULING

- .1 Submit to Departmental Representative copy of notifications prior to start of Work.
- .2 Hours of Work: perform work during normal working hours.

1.11 OWNER'S 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 containers in accordance with Asbestos Regulations 29 CFR 1910.1001. 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.
- .9 Encapsulants: Type 1 penetrating type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada having following characteristics:
- .10 Sprayed fireproofing: ULC labelled and listed asbestos-free to provide degree of fire or thermal protection required.

Part 3 Execution

3.1 PREPARATION

- .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
- .2 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

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- duct work is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.
- .2 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.
 - .3 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.
 - .4 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, 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.
 - .5 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
 - .6 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.
 - .7 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.
 - .8 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)".
 - .9 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.
 - .10 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.
 - .11 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.

- .12 After preparation of work areas and Decontamination Enclosure Systems, for the removal of all other asbestos containing materials, remove within work area and dispose of as contaminated waste in specified containers. Spray asbestos debris and immediate work area with amended water to reduce dust, as work progresses.
- .3 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 area[s], with two curtained doorways, one to Shower Room and one to work area[s]. Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in work area[s]. 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. Provide piping and connect to water sources and drains. Pump waste water through 5 micrometre filter system 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.
 - .4 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

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- 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.
- .5 Construction of Decontamination Enclosures:
- .1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. [.
- .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.
- .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 Consultant.
- .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 area[s] and decontamination enclosures 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 Where Departmental Representative decides complete removal of asbestos containing material is impossible due to obstructions such as structural members or major service elements, and provides written direction, encapsulate material as follows:
 - .1 Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces uniformly to substrate.
- .6 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 Consultant 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.
- .7 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.
- .8 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 specified above, and when air sampling shows that asbestos levels on both sides of seals do not exceed 0.01 fibres/cc as determined by membrane filter method at 400-500X magnification phase contrast illumination, as described in NIOSH Method 94-113 or equivalent, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of 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 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Contractor to take air samples inside and outside of Asbestos Work Area enclosure[s] in accordance with British Columbia's Occupational Health and Safety Regulation and the current version of the WorkSafeBC Manual entitled "Safe Work Practices for Handling Asbestos".
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.
 - .1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure at no additional cost to Owner.

- .2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to work areas at no additional cost to Owner.
- .3 During course of Work, Contractor to measure fibre content of air outside work areas by means air samples analyzed by Phase Contrast Microscopy (PCM).
 - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.
- .4 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Contractor will perform 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, at no cost to Owner.

3.6 INSPECTION

- .1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviation from these requirements that have not been approved in writing by Departmental Representative may result in Work stoppage, at no cost to Owner.
- .2 Contractor 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 OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- .2 Openings in forms for other work.
- .3 Form accessories.
- .4 Form stripping.

1.2 RELATED SECTIONS

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-Place Concrete: Supply of concrete accessories for placement by this section.

1.3 DESIGN REQUIREMENTS

- .1 Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.
- .2 Conform to CSA-S269.1.

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Shop Drawings:
 - .1 Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
 - .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts.
 - .3 Comply with CAN/CSA-S269.3 for form work Drawings.
 - .4 Provide Shop Drawings stamped and signed by a Professional Engineer registered or licensed in the British Columbia, Canada.

Part 2 Products

2.1 WOOD FORM MATERIALS

- .1 Form Materials: At the discretion of the Contractor.
- .2 Softwood Plywood: CSA-O151, C Grade, Group 2.
- .3 Plywood: CSA-O121, Douglas Fir species; select sheathing grade; sound undamaged sheets with clean, true edges.
- .4 Lumber: Spruce-Pine-Fir species; No.1/No.2 grade; with grade stamp clearly visible.

2.2 FORMWORK ACCESSORIES

- .1 Form Ties: Snap-off type, galvanized metal, fixed length, cone type free of defects that could leave holes larger than 1 inch in concrete surface.
- .2 Form Release Agent:
 - .1 Colourless mineral oil which will not stain concrete, or absorb moisture or impair natural bonding or colour characteristics of coating intended for use on concrete.
 - .2 Non-toxic.
- .3 Form Stripping Agent: Colourless mineral oil, non-toxic free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 104 degrees F, flashpoint minimum 302 degrees F, open cup.
- .4 Dovetail Anchor Slot: Galvanized steel, 22 gauge thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- .5 Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

Part 3 Execution

3.1 ERECTION - FORMWORK

- .1 Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of CAN/CSA-S269.3.
- .2 Fabricate and erect false work in accordance with CSA-S269.1.
- .3 Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- .4 Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- .5 Align joints and make watertight. Keep form joints to a minimum.
- .6 Obtain approval before framing openings in structural members which are not indicated on Drawings.
- .7 Install void forms where applicable in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- .8 Coordinate this section with other sections of work which require attachment of components to formwork.
- .9 If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Departmental Representative.

3.2 APPLICATION - FORM RELEASE AGENT

- .1 Apply form release agent on formwork in accordance with manufacturer's recommendations.
- .2 Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- .3 Do not apply form release agent where concrete surfaces will receive special finishes which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.3 INSERTS, EMBEDDED PARTS, AND OPENINGS

- .1 Provide formed openings where required for items to be embedded in passing through concrete work.
- .2 Locate and set in place items which will be cast directly into concrete.
- .3 Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- .4 Install accessories in accordance with manufacturer's written instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- .5 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- .6 Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.4 FORMWORK TOLERANCES

- .1 Construct formwork to maintain tolerances in accordance with CSA-A23.1/A23.2.
- .2 Construct and align formwork for elevator hoistway in accordance with CSA-B44.

3.5 FORM REMOVAL

- .1 Do not remove forms or bracing until concrete has 75% of its 28-day compressive strength.
- .2 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- .3 Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Reinforcing steel bars, wire fabric and accessories for other concrete.

1.2 RELATED SECTIONS

- .1 Section 03 11 00 - Concrete Forming.
- .2 Section 03 30 00 - Cast-in-place Concrete.

1.3 REFERENCES

- .1 ASTM A82/A82M-07 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- .2 ASTM A184/A184M-06(2011) - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- .3 ASTM A496/A496M-07 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
- .4 ASTM A497/A497M-07 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
- .5 CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .6 CAN/CSA-A23.3-04 (R2010) - Design of Concrete Structures.
- .7 CSA-G30.18-09 - Carbon Steel Bars for Concrete Reinforcement.
- .8 CSA-G40.20-04/G40.21-04 (R2009) - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
- .9 RSIC (Reinforcing Steel Institute of Canada) – Manual of Standard Practice (2004).

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Procedures for submittals.
- .2 Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, supporting and spacing devices.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Procedures for submittals.
- .2 Test Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.6 QUALITY ASSURANCE

- .1 Perform Work in accordance with CSA-A23.1/A23.2. Maintain one (1) copy of document on site.
- .2 Welders' Certificates: Submit to Section 01 43 00, Manufacturer's Certificates, certifying welders employed on the Work, verifying CSA-qualification within the previous 12 months.

Part 2 Products

2.1 REINFORCEMENT

- .1 Reinforcing Steel, Deformed: CSA-G30.18, billet steel, Grade 400W, weldable bars, .
- .2 Reinforcing Steel, Plain: CSA-G30.18, carbon steel, Grade 400R, bars, unfinished.
- .3 Welded Steel Wire Reinforcement, Plain: ASTM A185/A185M, in flat sheets, galvanized.
- .4 Welded Steel Wire Reinforcement, Deformed: ASTM A497/A497M, in flat sheets, unfinished .

2.2 ACCESSORIES

- .1 Tie Wire: Minimum 16 gauge annealed type.
- .2 Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapour barrier puncture.
- .3 Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2.3 FABRICATION

- .1 Fabricate concrete reinforcing in accordance with:
 - .1 CSA-A23.1/A23.2.
 - .2 RSIC - Reinforcing Steel Manual of Standard Practice.
- .2 Weld reinforcement in accordance with CSA-W186.
- .3 Locate reinforcing splices not indicated on drawings, at point of minimum stress.

Part 3 Execution

3.1 PLACEMENT

- .1 Place, support and secure reinforcement against displacement to CSA-A23.1/A23.2 and as indicated on reviewed placing Drawings.
- .2 Do not displace or damage vapour barrier.
- .3 Accommodate placement of formed openings.
- .4 Maintain concrete cover around reinforcing as noted on the drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Cast-in-place concrete equipment pads, floors and slabs on grade and foundation walls.
- .2 Control, expansion and contraction joint devices associated with concrete work including embedments and joint sealants.

1.2 RELATED SECTIONS

- .1 Section 03 11 00 - Concrete Forming: Formwork and accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.

1.3 REFERENCES

- .1 ASTM C260/C260M-10a - Standard Specification for Air-Entraining Admixtures for Concrete.
- .2 ASTM C494/C494M-12 - Standard Specification for Chemical Admixtures for Concrete.
- .3 ASTM C1017/C1017M-07 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .4 ASTM D994/D994M-11 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- .5 CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .6 CAN/CSA-A3000-08 - Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.4 SUBMITTALS FOR INFORMATION

- .1 Test Data: Minimum four (4) weeks prior to starting concrete work, submit manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Supplementary cementing materials.
 - .3 Grout.
 - .4 Admixtures.
 - .5 Aggregates.
 - .6 Water.
- .2 Certification: Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with .

1.5 QUALITY ASSURANCE

- .1 Perform Work in accordance with CSA-A23.1/A23.2.
- .2 Maintain one (1) copy of document on site.

- .3 Acquire cement and aggregate from same source for all work.
- .4 Conform to CSA-A23.1/A23.2 when concreting during hot weather.
- .5 Conform to CSA-A23.1/A23.2 when concreting during cold weather.

Part 2 Products

2.1 CONCRETE MATERIALS

- .1 Hydraulic Cement: CAN/CSA-A3000, Type GU; Grey colour.
- .2 Blended Hydraulic Cement: CAN/CSA-A3000, Type GUb; Grey colour.
- .3 Supplementary Cementing Materials: CAN/CSA-A3000, Natural Pozzolan, Type N.
- .4 Fine Aggregates: Normal density aggregates, graded to CSA-A23.1/A23.2; maximum aggregate size 3/8 inch.
- .5 Coarse Aggregates: Normal density aggregates, graded to CSA-A23.1/A23.2; maximum aggregate size <Insert Value> inch.
- .6 Water: CSA-A23.1/A23.2, clean and not detrimental to concrete.

2.2 ADMIXTURES

- .1 Air Entrainment: Air-entraining admixtures are to conform to the requirements of ASTM C260. The admixture is to be of uniform consistency and quality within each container and from shipment to shipment.
- .2 Chemical Admixtures: Water-reducing admixtures are to conform to the requirements of ASTM C494, Type A or D. The admixture is to be of uniform consistency and quality within each container and from shipment to shipment.
- .3 Superplasticizers (high-range water reducers) are to conform to the requirements of ASTM C494, Type F or G.

2.3 ACCESSORIES

- .1 Bonding Agent: Epoxy bonding agent.
- .2 Vapour Retarder: 10 mil thick clear polyethylene film, type recommended for below grade application.
- .3 Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2460 psi in 48 hours and 7000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

- .1 Joint Filler Type A: ASTM D1751, asphalt impregnated fibreboard or felt, thickness as noted on drawings; tongue and groove profile.
- .2 Joint Filler Type B: ASTM D1752, Type I - Sponge rubber, resiliency recovery of 90% when compressed to 50% of original thickness, or as required by ASTM D1752.
- .3 Ribbed Water Stops: Extruded PVC, Arctic Grade:

2.5 CONCRETE MIX

- .1 Mix and deliver normal density concrete in accordance with CSA-A23.1/A23.2, properties as specified on drawings.
- .2 Use accelerating admixtures in cold weather only when approved by the Departmental Representative. Use of admixtures will not relax cold weather placement requirements.
- .3 Use set retarding admixtures during hot weather only when approved by Departmental Representative.
- .4 Add air entraining agent to normal weight concrete mix for work exposed to exterior.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify all dimensions and locations required on drawings.
- .2 Verify requirements for concrete cover over reinforcement.
- .3 Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not impede concrete placement.
- .4 Verify locations of all openings and embedments required for other mechanical and architectural work.

3.2 PREPARATION

- .1 Prepare previously placed concrete by sanding with abrasive wheel and applying bonding agent to manufacturer's written instructions.
- .2 In locations where new concrete is dowelled to existing work, drill holes in existing concrete, hole size as recommended by adhesive manufacturer. Install adhesive anchors and let set to manufacturer's specifications.
- .3 Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

3.3 PLACING CONCRETE

- .1 Place concrete in accordance with CSA-A23.1/A23.2.
- .2 Notify Departmental Representative minimum seventy-two (72) hours prior to commencement of operations.
- .3 Ensure reinforcement, inserts are not disturbed during concrete placement.
- .4 Install vapour retarder under interior slabs on grade. Lap joints minimum 12 inches and seal watertight by taping edges and ends.
- .5 Repair vapour retarder damaged during placement of concrete reinforcing. Repair with vapour retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- .6 Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- .7 Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section drawing notes and specifications for finish joint sealer requirements.

- .8 Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- .9 Place concrete continuously between predetermined expansion, control, or construction joints.
- .10 Do not interrupt successive placement; do not permit cold joints to occur.
- .11 Saw cut joints within twenty-four (24) hours after placing. Use 3/16 inch thick blade, cut minimum 1/4 depth of slab thickness.
- .12 Screed floors level, maintaining surface flatness to CSA-A23.1/A23.2.

3.4 CONCRETE FINISHING

- .1 Finish concrete floor surfaces in accordance with CSA-A23.1/A23.2.
- .2 Steel trowel surfaces which will receive floor finishing.
- .3 Fine broom finish surfaces which are scheduled to be exposed.
- .4 In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:50 nominal.

3.5 CURING AND PROTECTION

- .1 Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical damage.
- .2 Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- .3 Maintain a temperature of 10 degrees Celsius for a minimum of 4 days after placement.
- .4 Cure floor surfaces in accordance with CSA-A23.1/A23.2.
- .5 Ponding: Maintain 100% coverage of water over floor slab areas continuously for four (4) days.
- .6 Spraying: Spray water over floor slab areas and maintain wet cure for seven (7) days.

3.6 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Field testing and inspection.
- .2 Provide free access to Work and cooperate with appointed firm.
- .3 Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of Work.
- .4 Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- .5 Three (3) concrete test cylinders will be taken and tested for every 100 cu yds or less, of each class of concrete placed.
 - .1 Minimum one (1) test per day.
 - .2 One (1) test per type of component, Piers, walls, columns and slabs.
- .6 One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

- .7 One slump or flow test and one air test will be taken for each set of test cylinders.

3.7 PATCHING

- .1 Allow Departmental Representative to inspect concrete surfaces immediately upon removal of forms.
- .2 Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Departmental Representative upon discovery.
- .3 Patch imperfections as directed.

3.8 DEFECTIVE CONCRETE

- .1 Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Departmental Representative.
- .3 Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Departmental Representative for each individual area.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 74 19 - Waste Management and Disposal

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .2 CSA International
 - .1 CAN/CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.
 - .2 Include application instructions for concrete floor treatments.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting:
 - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .2 Electrical power:
 - .1 Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:

- .1 Make work area water tight protected against rain and detrimental weather conditions.
- .4 Temperature:
 - .1 Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture:
 - .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
- .6 Safety:
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
 - .1 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.
 - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .3 Provide continuous ventilation during and after coating application.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
- .2 Delivery and Acceptance Requirements:
 - .1 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, in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Product

2.1 PERFORMANCE REQUIREMENTS

- .1 Product quality and quality of work in accordance with Section 01 61 00 - Product Requirements.
- .2 Submit written declaration that components used are compatible and will not

adversely affect finished flooring products and their installation adhesives.

2.2 CHEMICAL HARDENERS

- .1 Type 1 - Sodium silicate.
- .2 Water: potable.

2.3 SEALING COMPOUNDS

- .1 Surface sealer: to CAN/CGSB-25.20, Type 1 - solvent-based, clear.
- .2 Surface sealers are not manufactured or formulated with aromatic solvents hexavalent chromium and their compounds .

2.4 CURING COMPOUNDS

- .1 Select water-based, organic-solvent free curing compounds.

2.5 MIXES

- .1 Mixing ratios in accordance with manufacturer's written instructions.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that slab surfaces are ready to receive work and elevations are as recommended by manufacturer's written instructions.

3.2 PREPARATION OF EXISTING SLAB

- .1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.
- .2 Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.
- .3 Use strong solvent to remove chlorinated rubber or existing surface coatings.
- .4 Use protective clothing during stripping of chlorinated rubber or existing surface coatings.

3.3 APPLICATION

- .1 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.
- .2 Apply floor treatment in accordance with Sealer manufacturer's written instructions.

.3 Clean over spray. Clean sealant from adjacent surfaces.

3.4 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.5 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Structural steel framing members, support members.
- .2 Grouting under base plates.

1.2 RELATED SECTIONS

- .1 Section 05 31 13 - Steel Decking

1.3 REFERENCES

- .1 AISC 303-05 - Code of Standard Practise for Steel Buildings and Bridges.
- .2 ASTM A36/A36M-12 - Standard Specification for Carbon Structural Steel.
- .3 ASTM A108-07 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
- .4 ASTM A307-12 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- .5 ASTM A325M-13 - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength.
- .6 ASTM A500/A500M-10a - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- .7 ASTM A572/A572M-07 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- .8 AWS A2.1-DC - Welding Symbols Chart - Desk Chart.
- .9 AWS D1.1/D1.1M-2010 - Structural Welding Code - Steel.
- .10 CSA-G40.20-04/G40.21-04 (R2009) - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
- .11 CSA-S16-09 - Design of Steel Structures.
- .12 CISC - Code of Standard Practice - Manual of Steel Construction - Allowable Stress Design (ASD).
- .13 CSA-W47.1-09 - Certification of Companies for Fusion Welding of Steel.
- .14 CSA-W48-06 (R2011) - Filler Metals and Allied Materials for Metal Arc Welding.
- .15 CSA-W55.3-08 - Certification of Companies for Resistance Welding of Steel and Aluminum.
- .16 CSA-W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding).

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Shop Drawings:
 - .1 Indicate openings, spacing, locations of structural members and sizes.

- .2 Connections.
- .3 loads and Cambers.
- .4 Indicate welded connections with AWS A2.1 welding symbols. Indicate net weld lengths.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures.
- .2 Manufacturer's Mill Certificate: Certify that Products meet or exceed specified requirements.
- .3 Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.

1.6 QUALITY ASSURANCE

- .1 Perform Work to CISC standards.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.
- .4 Welders' Certificates: Submit to Section 01 33 00, certifying welders employed on the Work, verifying qualification within the previous twelve (12 months) to CSA-W47.1.
- .5 Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.

Part 2 Products

2.1 MATERIALS

- .1 Structural Steel Members: CSA-G40.20/G40.21, Grade 350W unless otherwise noted.
- .2 Structural Round Tubing: ASTM A500/A500M, Grade 46.
- .3 Bolts, Nuts, and Washers: ASTM A325 bolts.
- .4 Anchor Bolts: As indicated on Drawings.
- .5 Welding Materials: Type required for materials being welded.
- .6 Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7000 psi at 28 days.
- .7 Shop and Touch-Up Primer: SSPC-Paint 15 shop primer, and compatible with topcoat.

2.2 FABRICATION

- .1 Fabricate structural steel to CSA-S16 and in accordance with reviewed Shop Drawings.
- .2 Develop required camber for members.

2.3 FINISH

- .1 Clean, prepare surfaces, and shop prime structural members to CSA-S16, except as noted below.
- .2 Leave structural steel members noted on drawings un-primed.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 7: Verify existing conditions before starting work.

3.2 ERECTION

- .1 Erect structural members to CSA-S16.
- .2 Perform welding: CSA-W59.
- .3 Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- .4 Field weld components indicated on Drawings.
- .5 Field connect members with threaded fasteners; torque to required resistance.
- .6 Do not field cut or alter structural members without approval of Departmental Representative.
- .7 After erection, prime welds, abrasions, and surfaces not galvanized, except surfaces to be in contact with concrete.

3.3 ERECTION TOLERANCES

- .1 Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Steel roof and/or floor decks and accessories.
- .2 Bearing plates and angles.

1.2 RELATED SECTIONS

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-place Concrete

1.3 REFERENCES

- .1 ASTM A36/A36M-12 - Standard Specification for Carbon Structural Steel.
- .2 ASTM A108-07 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
- .3 ASTM A653/A653M-11 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 AWS D1.1/D1.1M-2010 - Structural Welding Code - Steel.
- .5 CAN/CSA-S136-07 (R2012) - North American Specification for the Design of Cold-Formed Steel Structural Members.
- .6 CSA-W47.1-09 - Certification of Companies for Fusion Welding of Steel.
- .7 CSA-W48-06 (R2011) - Filler Metals and Allied Materials for Metal Arc Welding.
- .8 CSA-W55.3-08 - Certification of Companies for Resistance Welding of Steel and Aluminum.
- .9 CSA-W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding).
- .10 CSSBI 12M-08 - Standard for Composite Steel Deck.
- .11 CSSBI - Design in Cold Formed Steel.
- .12 FM (Factory Mutual) - Roof Assembly Classifications.
- .13 SDI (Steel Deck Institute) - Design Manual for Composite Decks, Form Decks and Roof Decks, No. 31.
- .14 SSPC (The Society for Protective Coatings) - Steel Structures Painting Manual.
- .15 ULC - Building Materials Directory.

1.4 PERFORMANCE REQUIREMENTS

- .1 Design metal deck to CSA-S136.
- .2 Calculate to structural limit stress design and maximum vertical deck deflection of 1/240.

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide deck profile characteristics and dimensions, structural properties,

finishes.

- .3 Shop Drawings: Indicate deck plan, support locations, projections, openings reinforcement pertinent details, and accessories.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures.
- .2 Certificates: Certify that Products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

- .1 Conform to CAN/CSA-S136
- .2 Welders' Certificates: Submit to Section 01 33 00, certifying welders employed on the Work, verifying qualification within the previous twelve (12) months to CSA-W47.1.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.
- .4 Design deck layout, spans, fastening, joints, under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Cut plastic wrap to encourage ventilation.
- .3 Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

Part 2 Products

2.1 MATERIALS

- .1 Sheet Steel: ASTM A653/A653M, Structural Quality; with G30 galvanized coating.
- .2 Welding Materials: Type required for materials being welded.
- .3 Shop and Touch-Up Primer: SSPC-Paint 25, zinc oxide alkyd primer.
- .4 Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic zinc-rich primer.

2.2 FABRICATION

- .1 Metal Deck: Sheet steel, configured as follows:
 - .1 Span Design: Multiple.
 - .2 Minimum Metal Thickness Excluding Finish: 22 gauge.
 - .3 Nominal Height: 1-1/2 inch to SDI NR
 - .4 Formed Sheet Width: 32 inch.
 - .5 Side Joints: Lapped.

- .6 Flute Spacing: 152mm
- .2 Lap Fasteners: Galvanized hardened steel, self tapping.
- .3 Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 70 00: Verify existing conditions before starting work.

3.2 INSTALLATION

- .1 Erect metal deck to manufacturer's written instructions.
- .2 Erect metal deck to CSSBI 12M.
- .3 Bear deck on steel supports with 1-1/2 inch minimum bearing. Align and level.
- .4 Fasten steel deck to supporting members as indicated on drawings.
- .5 Weld to CSA-W59.
- .6 Mechanically fasten side laps as shown on drawings.
- .7 Reinforce steel deck openings from 6 to 18 inches in size with 2 x 2 x 1/4 inch steel angles. Place angles perpendicular to flutes; extend minimum two (2) flutes beyond each side of opening and fusion weld to deck at each flute.
- .8 Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up prime paint.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 74 19 - Waste Management and Disposal
- .3 Section 07 92 10 - Joint Sealants
- .4 Section 08 11 00 - Metal Doors and Frames
- .5 Section 09 29 00 - Gypsum Board Assemblies
- .6 Section 09 91 99 - Painting for Minor Works

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.
- .2 CSA International
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O121-08, Douglas Fir Plywood.
 - .3 CSA O141-05(R2009), Softwood Lumber.
 - .4 CSA O151-09, Canadian Softwood Plywood.
- .3 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2010.
- .4 The Truss Plate Institute of Canada
 - .1 Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses 2007.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories 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 British Columbia, Canada.

1.4 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood and wood based composite panels in accordance with CSA and ANSI standards.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
- .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 wood from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Product

2.1 FRAMING AND STRUCTURAL MATERIALS

- .1 Lumber: SPF No.2, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CAN/CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Light-frame trusses in accordance with "Truss Design and Procedures for Light Metal Connected Wood Trusses", The Truss Plate Institute of Canada.
- .3 Furring, strapping, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.

- .2 Dimension sizes: "Standard" light framing or better grade.

2.2 PANEL MATERIALS

- .1 Interior Plywood: G1S plywood conforming to CSA O121, thickness as indicated.
- .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .3 Canadian softwood plywood (CSP): to CSA O151, standard construction.

2.3 ACCESSORIES

- .1 Exterior wall sheathing paper: to CAN/CGSB-51.32 spunbonded olefin as indicated.
- .2 Polyethylene film: to CAN/CGSB-51.34, Type 1, 0.15 mm thick.
- .3 Air seal: closed cell polyurethane or polyethylene.
- .4 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .5 General purpose adhesive: to CSA O112.9.
- .6 Nails, spikes and staples: to CSA B111.
- .7 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .8 Air / Vapour Barrier: SBS bitumen, self-adhesive, non-woven glass fibre, top side sanded, to ASTM D1970.
- .9 Fastener Finishes:
 - .1 Galvanizing: to ASTM A123/A123M, use galvanized fasteners for fire-retardant.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product 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 Comply with requirements of NBCC 2010.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Install furring and blocking as required to space-out and support wall and ceiling finishes, facings, fascia, soffit, siding electrical equipment mounting boards, and other work as required.
- .4 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.
 - .1 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .5 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .6 Install wood fascia backing, nailers, curbs and other wood supports as required and secure using steel fasteners.
- .7 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.
- .8 Install self-adhesive air/vapour barrier to interior wall of Chlorine Room; Water Room side only.
- .9 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .10 Countersink bolts where necessary to provide clearance for other work.
- .11 Foam-in-place insulation to exterior metal door frames and around protrusions through the exterior wall envelope to achieve and maintain continuity of the air/vapour barrier.

3.3 CLEANING

- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment .
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .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 rough carpentry installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Structural floor, wall, and roof framing.
- .2 Built-up structural beams.
- .3 Floor, wall, and roof sheathing.
- .4 Sill gaskets.
- .5 Miscellaneous framing and sheathing.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete: Setting anchors in concrete.

1.3 REFERENCES

- .1 ASTM D3498-03(2011) - Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .2 CAN/CGSB 11.3-M87 - Hardboard.
- .3 CANPLY (Canadian Plywood Association) - Canadian Plywood Handbook.
- .4 CAN/CSA-O80 Series-08 (R2012) - Wood Preservation.CAN/CSA-O80 Series-08 (R2012) - Wood Preservation.
 - .1 CSA-O80.1-08 - Specification for Treated Wood.
 - .2 CSA-O80.3-08 - Preservative Formulations.
- .5 CSA-O121-08 (R2013) - Douglas Fir Plywood.
- .6 CSA-O151-09 - Canadian Softwood Plywood.
- .7 CSA-O153-13 - Poplar Plywood.
- .8 CSA-O325-07 (R2012) - Construction Sheathing.
- .9 CSA-O437 Series-93 (R2011) - Standards on OSB and Waferboard.
- .10 NPA A208.1-2009 - Particleboard.
- .11 APA (The Engineered Wood Association) - Product Guide Grades and Specifications.
- .12 NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber, 2010 edition.

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide technical data on Structural Insulated Panels.
- .3 Shop Drawings For Prefabricated Structural Insulated Panels: Indicate dimensions, wood species and grades, component profiles, drilled holes, fasteners, connectors, erection details and sequence.

1.5 QUALITY ASSURANCE

- .1 Perform Work in accordance with the following agencies:
 - .1 Lumber Grading Agency: Certified by NLGA.
 - .2 Plywood Grading Agency: Certified by CANPLY.

1.6 DELIVERY, STORAGE, AND PROTECTION

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Protect materials from warping or other distortion by stacking in vertical position.

Part 2 Products

2.1 LUMBER MATERIALS

- .1 Lumber Grading Rules: NLGA.
- .2 All Wood Framing: As Specified on the Drawings, 19% maximum moisture content.

2.2 SHEATHING MATERIALS

- .1 Plywood Roof Sheathing: CSA-O121, Rated Sheathing, As Specified on the Drawings.
- .2 Plywood Wall Sheathing: CSA-O121, Rated Sheathing, As Specified on the Drawings.

2.3 SHEATHING AND UNDERLAYMENT LOCATIONS

- .1 Sloped Roof Sheathing: As Specified on the Drawings, 1220mm x2440mm sized sheets, tongue & groove edges.
- .2 Above Grade Wall Sheathing: As per Wall Panel Manufacturer, design criteria specified on drawings.

2.4 ACCESSORIES

- .1 Fasteners and Anchors:
 - .1 Screws and Nails: Material, type and size as noted on drawings.
 - .2 Anchors: Material, type and size as noted on drawings.
- .2 Sill Gasket (top of foundation wall): 1/4 inch thick, plate width as indicated, closed cell polyethylene foam.

Part 3 Execution

3.1 FRAMING

- .1 Set structural members level and plumb, in correct position.
- .2 Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

- .3 Place horizontal members, crown side up.
- .4 Construct load bearing framing members full length without splices.
- .5 Place sill gasket directly on cementitious foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

3.2 SHEATHING

- .1 Use sheathing clips between sheets between roof framing members.
- .2 Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.
- .3 Install plywood to two-span continuous.

3.3 ERECTION TOLERANCES

- .1 Section 01 73 00: Tolerances.
- .2 Framing Members: 1/4 inch from true position, maximum.
- .3 Surface Flatness of Floor: 1/4 inch in 10 ft maximum, and 1/2 inch in 30 ft maximum.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 74 19 - Waste Management and Disposal
- .3 Section 09 91 99 - Painting for Minor Works

1.2 REFERENCES

- .1 Canadian Construction Materials Centre (CCMC)
 - .1 CCMC Technical guide, "Stressed Skin Panels (with structural ribs) for Walls and Roofs", Master Format number 06122, updated 2004-03-08.
- .2 ICC Evaluation Service, Inc. (ICC-ES)
 - .1 Acceptance Criteria for Sandwich Panels, AC04, Approved February 2004.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, boards and Pipe Covering.

1.3 SUBMITTALS

- .1 Submit Submittal submissions: in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Shop Drawings: to be sealed by Engineer registered in the province of British Columbia.
- .3 Submit shop drawings to indicate project layout and elevations, design loads as per the drawings, dimensions and thickness of panels, connections, details and location of joints and gaskets including panel joints and joints required for thermal movement, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, accessories, materials and finishes.
- .4 Quality assurance submittals:
 - .1 Submit certificates in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
 - .2 For products treated with preservative by pressure impregnation submit following information certified by authorized signing officer of treatment plant:

- .1 Information listed in AWPA M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.
- .2 Moisture content after drying following treatment with water-borne preservative.
- .3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.

1.4 QUALITY ASSURANCE

- .1 Plant inspection of products treated with preservative by pressure impregnation will be carried out by designated testing laboratory to AWPA M2, and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.
- .2 Each piece of lumber and plywood for preserved wood foundations to be identified by CSA O322 certified stamp.
- .3 Regulatory Requirements:
 - .1 Each board or bundle of fire-retardant treated material to bear ULC label indicating Flame Spread Classification (FSC), and smoke developed.
- .4 Field Measurements: Request field measurements prior to completion of shop drawings and fabrication. Coordinate fabrication schedule with construction progress to avoid delay of work. NOTE: Field fabrication is allowed to ensure proper fit after consultation with manufacturer, but must be kept to minimum with majority of SIP fabrication being done under controlled shop conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Transport: All panels shall be wrapped at the plant and be delivered to the site in the original sealed packaging. Transport by truck requires that the load be completely tarped for protection. Air freight will have restrictions on dimensional size and weight.
- .2 Storage and Handling: Panels on the job site shall be kept in a dry location, stored on sleepers, and blocked to prevent warping or twisting. They shall be kept tarped at all times to protect from weather. Exterior finishing materials (i.e. wall and roof cladding) shall be installed as quickly as possible, preferably within a 2-week time frame to reduce the potential for damage from the elements. Do not allow the panels to become wet any time, as high moisture in the materials will reduce the load-carrying capacity.

2.1 MATERIALS

- .1 Preservative: to CSA-O80 Series, odourless, for clear finish.
 - .1 SCAQMD Rule #1113, Architectural Coatings.
- .2 Preservatives: maximum VOC limit 350 g/L.
- .3 Fire-Retardant: to CSA O80.20, to provide:
 - .1 Flame Spread Classification: FSC 25.
 - .2 Smoke developed of not more than: 50.
- .4 Solvent: to CSA-O80.201, odourless, max. VOC 350 g/L.
- .5 SIPs consist of the following:
 - .1 Expanded polystyrene (EPS) core -EPS insulation complying with CAN/ULC-S701, Type 1. Insulation manufacturer shall be identified with label of accredited Third Party Certification agency.
 - .2 Oriented Strand Board (OSB) - a performance rating mark shall be identified on the panel, with an Exposure 1 durability rating; minimum physical properties shall be tested and described in DOC PS2, APA PRP-108 and CSA 0325.0.
- .6 Adhesives shall be in conformance with ICC ES AC05 - Acceptance Criteria for Sandwich Panel adhesives.
- .7 Provide SIPs which have been manufactured, fabricated and installed to withstand specified loads as determined by design indicated on drawings in accordance with the local building codes and to maintain performance criteria as stated by the SIP manufacturer without defects, damage or product failure.
- .8 Refer to drawings for panel thickness.

2.2 ACCESSORIES

- .1 Splines:
 - .1 OSB, dimensional lumber, engineered wood or I-beam for use in joining SIPs shall be supplied by the SIP manufacturer as specified on approved SIP shop drawings.
- .2 Fasteners:
 - .1 Panel Screws as per SIP manufacturer design requirements shall be used following fastening requirements specified on approved SIP shop drawings. Panel screws are to be supplied by the SIP manufacturer or approved equal supplied by the SIP installer.
- .3 SIP Sealant:

- .1 Sealants shall be specifically designed for use with SIPs. Sealant must be compatible with all components of the SIP. Sealant is to be supplied by the SIP manufacturer or approved equal supplied by the SIP installer.
- .4 SIP Panel Seal Tape:
 - .1 Tape with an adhesive suitable for indoor use, minimum 6" (152 mm) wide for use on flat SIP joints and minimum 12" (304 mm) wide for use on opposing angled surfaces including ridge and roof-to-wall connections. SIP tape shall be supplied by the manufacturer.

Part 3 Execution

3.1 APPLICATION: FIRE-RETARDANT

- .1 Treat all material by pressure impregnation with fire-retardant chemicals in accordance with CSA 080.20.
- .2 Following treatment, kiln-dry material to maximum moisture content of 19%.
- .3 In lieu of pressure impregnated OSB, it is acceptable to factory paint OSB using Firefree88® intumescent, water based coat, Apply minimum 2 coats of paint.

3.2 APPLICATION: FIELD TREATMENT

- .1 Comply with AWPA M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.
- .2 Remove chemical deposits on treated wood to receive applied finish.

3.3 SITE ADVISORY SERVICES

- .1 The SIP manufacturer shall provide site advisory services for all aspects of the SIP construction, including floor, wall and ceiling panel installations.
- .2 The site advisor shall assist the Contractor by providing advice on working with SIP panels, guidance and interpretation of SIP panel shop drawings, and deal with any questions concerning the installation of manual.
- .3 The site advisor will not be expected to manage or supervise crews or carry out the actual installation work.

3.4 INSTALLATION

- .1 Install in compliance with product data, including product technical bulletins, application and installation instructions.
- .2 Provide components and/or openings for building by other sections in

- accordance with shop drawings and schedule.
- .3 Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.
 - .4 Conform to panel fabricator's instructions for installation of concealed fasteners.
 - .5 Do not install component parts that are observed to be defective, including: warped, bowed, dented and broken members.
 - .6 If any of the SIP panels become wet, they must be allowed to dry out thoroughly prior to cladding.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Shop fabricated wood trusses for roof framing.
- .2 Bridging, bracing, and anchorage.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete: Setting anchors in concrete.
- .2 Section 06 11 00 - Wood Framing: Structural dimension lumber framing.

1.3 REFERENCES

- .1 ASTM A167-99 (2009) - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 ASTM A653/A653M-11 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 CAN/CSA-O80 Series-08 (R2012) - Wood Preservation.
 - .1 CSA-O80.1-08 - Specification for Treated Wood.
 - .2 CSA-O80.3-08 - Preservative Formulations.
- .4 CSA-O86-09 (Consolidation) - Engineering design in wood.
- .5 CSA-O141-05 (R2009) - Softwood Lumber.
- .6 CSA-O437 Series-93 (R2011) - Standards on OSB and Waferboard.
- .7 CSA-S347-99 (R2009) - Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
- .8 CSA-W47.1-09 - Certification of Companies for Fusion Welding of Steel.
- .9 CSA-W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding).
- .10 NPA A208.1-2009 - Particleboard.
- .11 CANPLY (Canadian Plywood Association) - Canadian Plywood Handbook.
- .12 NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber, 2010 edition.
- .13 TPIC (Truss Plate Institute of Canada), TPIC-2011 - Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses, Limit States Design.

1.4 PERFORMANCE REQUIREMENTS

- .1 Design Roof Live Load: : As Noted On Drawings with deflection limited to 1/360 of span.

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide truss configurations, bearing and anchor details, bridging and bracing.

- .3 Shop Drawings: Indicate sizes and spacing of trusses and associated components, web and chord sizes, plate sizes, loads and truss cambers, framed openings. Submit design calculations.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures.

1.7 QUALITY ASSURANCE

- .1 Perform Work in accordance with the following agencies:
 - .1 Lumber Grading Agency: Certified by NLGA.
 - .2 Plywood Grading Agency: Certified by CANPLY.
- .2 Truss Design, Fabrication, and Installation: CSA-O86. Maintain one (1) copy of document on site.
- .3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .4 Pressure Preservative Treated Wood: Marked with certification mark authorized by the Canadian Wood Preservers Bureau (CWPB) indicating producer, preservative type, retention and Use Category (UC).
- .5 Design trusses under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for loads, seismic zoning, other governing load criteria.

1.9 DELIVERY, STORAGE, AND PROTECTION

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Store truss depth in vertical position resting on intermittent bearing pads.

Part 2 Products

2.1 MATERIALS

- .1 Lumber Grading Rules: NLGA.
- .2 Wood Members: Single top and bottom chord, S-P-F Species, No.1 / No.2 Grade, 19% maximum and 7% minimum moisture content.
- .3 Plywood Plate: CANPLY Rated Sheathing, Grade C-D.
- .4 Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.2 ACCESSORIES

- .1 Wood Blocking: Softwood lumber, S/P/F species, construction grade, 19% maximum and 7% minimum moisture content.
- .2 Fasteners and Anchors:

- .1 Fasteners: Galvanized steel, Type and Size : As Noted On Drawings .
- .2 Anchors: Type and Size : As Noted On Drawings .
- .3 Plates and Connectors:
 - .1 Steel Plate Connectors: Galvanized steel; die stamped with integral teeth.
 - .2 Bearing Plates: Galvanized steel.

2.3 FABRICATION

- .1 Fabricate trusses to achieve structural requirements specified.
- .2 Brace wood trusses for support to TPIC.
- .3 Provide top chord extensions as indicated.
- .4 Frame special sized openings in web framing as detailed.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that supports and openings are ready to receive trusses.

3.2 PREPARATION

- .1 Coordinate placement of support and bearing items.

3.3 INSTALLATION

- .1 Install trusses to TPIC.
- .2 Set members level and plumb, in correct position.
- .3 Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- .4 Do not field cut or alter structural members without approval of Consultant.
- .5 Place headers and supports to frame openings.
- .6 Coordinate placement of sheathing with work of this section.

3.4 ERECTION TOLERANCES

- .1 Framing Members: 1/2 inch maximum, from true position.

3.5 SCHEDULES

- .1 Main Roof: 24 inches on centre, no overhang as detailed on drawings, 6/12 slope.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 35 33 - Health and Safety Requirements
- .3 Section 01 74 19 - Waste Management and Disposal
- .4 Section 07 21 16 - Blanket Insulation
- .5 Section 07 26 00 - Vapour Retarders and Sheet Barriers
- .6 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C1126-04, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 - .2 ASTM E96/E96M-05, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
 - .2 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples . Indicate VOC's insulation products and adhesives.
- .2 Manufacturer's Instructions:

- .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

Part 2 Product

2.1 SLAB-ON-GRADE INSULATION

- .1 Rigid Insulation: Extruded polystyrene (XPS), closed cell, rigid: to CAN/ULC-S701, high density.
 - .1 Type: 4.
 - .2 Maximum water absorption: 0.7% in accordance with ASTM D2842.
 - .3 Compressive strength: 276 kPa.
 - .4 Thickness: as indicated.
 - .5 Edges: square.
 - .6 Application: Provide 100mm thickness as per drawings.
 - .7 Minimum 5 year aged R-value R5.0 per 25mm [1"] RSI=0.88 .

2.2 CONCRETE FACED RIGID INSULATION

- .1 Concrete Faced Rigid insulation, 8mm thick latex modified concrete facing:
 - .1 Type: 4
 - .2 Maximum water absorption: 0.7% in accordance with ASTM D2842.
 - .3 Compressive strength: 276 kPa
 - .4 Application: exterior of concrete foundation wall as per drawings.
 - .5 Thickness: as indicated.
 - .6 Edges: square.
 - .7 Minimum 5 year aged R-value R5.0 per 25mm [1"] RSI=0.88.

2.3 ADHESIVE

- .1 Adhesive (for polystyrene): to CGSB 71-GP-24.

2.4 ACCESSORIES

- .1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
- .2 Fasteners:
 - .1 Mechanical, non-corrosive fasteners for concrete application with drilled expansion type anchors and galvanized mounting clips.

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 WORKMANSHIP

- .1 Install insulation after building substrate materials are dry and level and air/vapour barrier has been verified as properly installed.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces. Install insulation tight fitting.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 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. All gaps and voids to be spray-foamed with compatible product.
- .5 Offset both vertical and horizontal joints in multiple layer applications.
- .6 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 EXAMINATION

- .1 Examine substrates and immediately inform Departmental Representative in writing of defects.
- .2 Prior to commencement of work ensure:

- .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 CONCRETE FACED RIGID INSULATION INSTALLATION

- .1 Ensure building substrate materials are dry and dampproofing is verified for proper installation in accordance with manufacturer's recommendations.
- .2 Fit insulation tight together, minimum gaps at joints, sprayfoam all gaps and voids to maintain continuous insulation layer.
- .3 Install non-corrosive anchors into concrete as per manufacturer's instructions. Do not use adhesive that is incompatible with rigid insulation.

3.5 SLAB-ON-GRADE INSULATION

- .1 Under slab application: extend boards as indicated on the drawings. Thickness and locations as indicated on the drawings.
 - .1 Protect insulation from damage or displacement.
 - .2 Lay boards on level, compacted fill.
 - .3 Install boards under complete slab.

3.6 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 74 19 - Waste Management and Disposal
- .3 Section 06 10 10 - Rough Carpentry
- .4 Section 07 92 00 - Joint Sealants
- .5 Section 09 21 16 - Gypsum Board Assemblies

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C1320-05, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples .
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety

Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse in accordance with Section 01 74 19 - Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate in accordance to Section 01 74 19.
- .3 Collect and separate for disposal paper packaging material for recycling in accordance with Waste Management Plan.

Part 2 Product

2.1 INSULATION

- .1 Batt and blanket mineral fibre: to CAN/ULC S702.
 - .1 Type: 1.A, preformed friction fit with no membrane, formaldehyde-free.
 - .2 Thickness: as indicated.

2.2 ACCESSORIES

- .1 Staples: 12 mm minimum leg.

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 INSULATION INSTALLATION

- .1 Install insulation to maintain continuity of acoustical protection to building elements and spaces and to ASTM C1320.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3 Do not compress insulation to fit into spaces.
- .4 In sound control assemblies, acoustically seal periphery of wall and all penetrations through the wall.

- .5 Do not enclose insulation until it has been reviewed and approved by Departmental Representative.

3.3 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Materials and installation methods providing primary air/vapour barrier materials and assemblies for exterior walls.
- .2 Air/vapour barrier materials to provide continuous seal between components of building envelope and building penetrations.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Product Data:
 - .1 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) Material Safety Data Sheets (MSDS).
- .4 Quality assurance submittals:
 - .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 and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

1.4 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
- .2 Mock-Ups:
 - .1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .2 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
 - .3 Mock-up will be used to judge 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 vapour barrier work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 19 - Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.6 PROJECT ENVIRONMENTAL REQUIREMENTS

- .1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.7 SEQUENCING

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.8 WARRANTY

- .1 For sheet materials the 12 months warranty period prescribed in General Conditions is extended to 24 months.
- .2 Provide a three year joint manufacture and installer's warranty under provisions of Section 01 78 00 - Maintenance Requirements.

- .3 Warranty: Include coverage of installed sheet materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

Part 2 Product

2.1 WALL AND ROOF AIR/VAPOUR BARRIER

- .1 Sheet Seal Type 1 for Exterior Walls: refer to Section 06 10 00.
- .2 Sheet Seal Type 2 for Roofs and Foundation Walls: to CGSB 37-GP-56M, Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, glass reinforcement, weighing 180 g/m², sanded.
 - .1 Standard of Acceptance: Lastobond Shield HT by Soprema .
 - .2 Sheet Seal Transition Flashing Type 3 for Roof to Wall transitions and Wall to Window/Door System: Self-Adhesive bitumin modified with thermoplastic polymers, laminated to high-density polyethylene film, nominal total thickness of 0.8mm (32 mil).
 - .3 Standard of Acceptance: SOPRASEAL STICK 1100T by Soprema.
- .3 Sheet Seal Type 3: Polyethylene film Groundsheet : to CAN/CGSB-51.34, 10 mil thick.

2.2 WEATHER BARRIER

- .1 Weather Barrier Type 1: Standard of Acceptance: exterior wall sheathing paper to CAN2-51.32, spunbound olefin type, Tyvek by Dupont.

2.3 PRIMERS

- .1 Roof and Wall Sheathing Primer:
 - .1 Standard of Acceptance: Elastomeric bitumen, volatile solvents and adhesive enhancing additives, Elastocol 500 by Soprema.
- .2 Flashing Primer:
 - .1 Standard of Acceptance: ELASTOCOL STICK primer for self-adhesive membrane by SOPREMA.

2.4 ACCESSORIES

- .1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
- .2 Thinner and cleaner for sheet barrier: As recommended by sheet material

manufacturer.

- .3 S.B.S. modified mastic : Standard of Acceptance: SOPRAMASTIC by SOPREMA.
- .4 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer. .

Part 3 Execution

3.1 INSTALLATION

- .1 Verify that surfaces and conditions are ready to accept the Work of this section.
- .2 Ensure all surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.
- .3 Report any unsatisfactory conditions to the Consultant in writing.
- .4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.
- .5 Ensure services are installed and inspected prior to installation of vapour retarder and air/vapour barrier.
- .6 Install air/vapour barrier (Type 2) over approved primer on foundation walls. For roof membrane (Type 2) installation see Section 07 61 00.
- .7 Install sheet weather barrier (Type 1) over S.I.P's prior to installation of ceiling to form continuous vapour retarder. wood strapping
- .8 After rigid insulation for slab-on-grade is level, install sheet polyethylene groundsheet (Type 3) over insulation. Overlap all joints and seal with sealing tape.
- .9 Use sheets of largest practical size to minimize joints.
- .10 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 PREPARATION

- .1 Remove loose or foreign matter which might impair adhesion of materials.
- .2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.
- .3 Ensure all substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces to receive adhesive in accordance with manufacturer's instructions.

3.3 ELECTRICAL BOXES

- .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
 - .1 Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.
 - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.4 INSTALLATION ROOF AIR/VAPOUR BARRIER

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Roof Air/Vapour Barrier: prime all surfaces to receive roof air/vapour barrier:
 - .1 Beginning at bottom of slope, without adhering the membrane, unroll onto substrate for alignment.
 - .2 Align roll parallel to roof substrate. Ensure membrane overlaps are supported.
 - .3 Apply Type 2 air/vapour barrier parallel to roof slope. Bond to be 100 percent.
 - .4 Side laps minimum 75 mm and end laps minimum 150 mm wide.
 - .5 Prevent undulations and fishmouths.
 - .6 Reinforce membrane at changes of direction and as recommended by membrane manufacturer..
 - .7 Connect roof membrane to metal flashings at eaves, rakes and penetrations in accordance with membrane manufacturers' recommendations and as indicated.
 - .8 Apply membrane within recommended application temperature ranges
- .3 Wall Weather Barrier: Prime all surfaces to receive wall air/vapour barrier on concrete foundation wall:
 - .1 Beginning at top of wall, without adhering the membrane, unroll onto wall for alignment.
 - .2 Align roll vertically. Ensure membrane overlaps are supported.
 - .3 Apply membrane to wall by peeling back silicone release sheet and

- roll flat with metal roller. Bond to be 100 percent.
- .4 Side laps minimum 75 mm and end laps minimum 150 mm wide.
 - .5 Prevent undulations and fishmouths.
 - .4 Transition Flashing: Prime all surfaces with recommended transition membrane primer:
 - .1 Beginning at top of transition, without adhering the membrane, unroll onto substrate for alignment. Do not immediately remove silicone release sheet.
 - .2 Align roll parallel to substrate. Ensure membrane overlaps are supported.
 - .3 Align over window flanges and flashings to ensure positive drainage away from air vapour barrier plane into rain screen cavity.
 - .4 Peel back one end of silicone release sheet and adhere to substrate. Avoid wrinkles in membrane.
 - .5 Overlap adjacent membranes by 75mm. Overlap end laps by 150mm. Stagger end laps by minimum of 300mm.
 - .6 Apply membrane within recommended application temperature ranges.
 - .5 Mastic: fill all gaps, joints and transitions with SBS mastic.
 - .6 Weather Barrier: install in accordance with manufacturer's written instructions.

3.5 SCHEDULES

- .1 Roof Air/Vapour Barrier: Type 2, refer to Section 07 61 00.
- .2 Door Frame Perimeter: Lap sheet Type 2 membrane from wall air seal surface with 75 mm of full contact over firm bearing to window frame with 50 mm of full contact. Edge seal with polyurethane insulation.
- .3 Wall and Roof Junction: Lap sheet Type 2 from wall seal material with 150 mm of contact over firm bearing to roof air seal membrane with 100 mm of full contact. Seal all joints.
- .4 Concrete Foundation Wall: Lap sheet Type 2 continuously over primer on foundation wall.
- .5 Weather Barrier Type 3: use behind Hardboard cladding systems with no open joints.

3.6 PROTECTION OF WORK

- .1 Protect finished Work in accordance with Section 01 61 00 - Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished Work is protected from climatic conditions.

3.7 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 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 74 19 - Waste and Disposal
- .3 Section 06 10 10 - Rough Carpentry.
- .4 Section 07 92 00 - Joint Sealants.
- .5 Section 07 62 00 - Sheet Metal Flashing and Trim: Supply of metal flashings and trim associated with cementitious siding for placement by this section.
- .6 Section 08 11 13 - Metal Doors and Frames
- .7 Section 09 91 99 - Painting for Minor Works.

1.2 REFERENCES

- .1 ASTM C 920 - Standard for Elastomeric Joint Sealants.
- .2 ASTM C 1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fibre Cement Flat Sheet, Roofing and Siding Shingles and Clapboards.
- .3 ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
- .4 ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Construction.
- .5 ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Product Data: Manufacturer's data sheets on each product to be used, including:
 - .1 Preparation instructions and recommendations.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation methods, including nailing patterns.
 - .4 Manufacturer's requirements for vapor retarders, primer, paint, etc.
- .3 Samples: Submit two (2) samples, 12 x 12 inch in size illustrating surface texture and colour.

1.4 DELIVERY, STORAGE, AND PROTECTION

- .1 Store products off the ground, on a flat surface, and under a roof or separate waterproof covering.

1.5 WARRANTY

- .1 Provide Weatherboards with a 50 year limited siding warranty.
- .2 CertainTeed ColorMax Finish: provide 15 year limited paint warranty.
- .3 Register manufacturer's warranty, made out in Owner's name, with copy to Owner.

Part 2 Products

2.1 PRODUCTS

- .1 Horizontal Fiber Cement Siding: Standard of Acceptance - Allura (CertainTeed WeatherBoards) Lap Siding;
 - .1 Thickness: 7.9 mm
 - .2 Length: 3657 mm
 - .3 Style: Smooth lap siding
 - .4 Width: 8.25" [210 mm] panel
 - .5 Finish: Factory applied ColorMax Finishing System by CertainTeed with 100 percent acrylic solid colour.
 - .6 Colour: Selected by Departmental Representative from submitted product literature in accordance with Section 01 33 00.

2.2 ACCESSORIES

- .1 Screws: Hot dipped galvanized type; non-staining, of size and strength to securely and rigidly retain the work as per manufacturer's recommendations.
- .2 Sheet Metal Flashing: minimum 26 gauge [0.46mm] hot-dipped galvanized steel sheet or coated aluminum.
- .3 Door, Corner and Louvre trim: prefinished fiber cement trim, smooth, 140mm wide x 3657 long sections. Standard of Acceptance: Allura Fiber Cement Trim. Colour to match lap siding.
- .4 Perforated Soffit: smooth, perforated fiber cement soffit. Standard of Acceptance: Allura Fiber Cement Soffit. Colour to match lap siding.
- .5 Sealant/Primer: in accordance with Section 07 92 00 - Joint Sealants. Colour to match siding and trim.

- .6 Insect screen: black, nylon insect mesh.
- .7 Field Finish Paint: 100 percent Acrylic latex as per Section 09 91 00.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION - BOARD SIDING

- .1 Install in accordance with manufacturer's instructions and drawing details.
- .2 Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses. Mitre horizontal joints tight at 45 degrees.
- .3 Installation on strapping: Leave space at top and bottom open; top may be behind soffit; at bottom install insect screen over opening by wrapping a strip of nylon screen over bottom end of vertical strapping.
- .4 Install continuous starter strips, outside corners, edgings, drip, cap and sill flashings as indicated.
- .5 Pre-drill nail holes if necessary to prevent breakage.
- .6 Allow space between both ends of siding boards that butt against trim for thermal movement; seal joint between board and trim with exterior grade sealant.
- .7 Touch-up all field cut edges before installing. Unsightly touch-up will require removal and replacement of affected siding.
- .8 Install sheet metal flashing above door trim. Refer to Section 07 62 00.
- .9 Coordinate mechanical and electrical penetrations. Mount mechanical and electrical devices on smooth, raised panel c/w perimeter sealant.
- .10 Install corner boards, soffit and trim.
- .11 Do not install siding less than 150mm (6") from the top of grade or 25mm (1") from other surfaces where water may collect.
- .12 After installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.

3.3 PREPARATION FOR SITE FINISHING

- .1 At completion of work, remove debris caused by siding installation from

project site.

- .2 Touch-up, repair or replace damaged products prior to Substantial Completion.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 45 00 - Quality Control
- .3 Section 01 74 19 - Waste and Disposal
- .4 Section 06 17 56 - Plate-Connected Roof Trusses
- .5 Section 07 62 00 - Sheet Metal Flashing and Trim
- .6 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A653/A653M-10, 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-37.5-M89, Cutback Asphalt Plastic Cement.
 - .2 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
 - .1 CCMC-2011, Registry of Product Evaluations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples .
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product

- characteristics, performance criteria, physical size, finish and limitations.
- .2 Proof of manufacturer's CCMC listing and listing number.
- .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
- .4 Samples:
 - .1 Submit 300 x 300 mm samples of each sheet metal material.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 sheet metal roofing from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Product

2.1 SHEET METAL MATERIALS

- .1 Metal Roof Cladding: to CAN/CGSB - 93.4-92, ASTM A792, Grade 33, AZ150;
 - .1 Finish coating; Series 5000.
 - .2 Colour: To match existing duplex houses. To be confirmed by Contractor.
 - .3 Gloss: Low.
 - .4 Thickness: 0.61mm (24 gauge) base metal thickness.
 - .5 Coverage: 878 mm.

- .6 Standard of Acceptance: 22mm (7/8") corrugated metal roofing by VicWest.
- .2 Exposed Trim : to CAN/CGSB - 93.4.92:
 - .1 Finish coating; Series 5000.
 - .2 Colour: to match roofing colour.
 - .3 Gloss: Low.
 - .4 Thickness: 0.61mm (24 gauge) base metal thickness.
 - .5 Profile; As indicated on Drawings.
- .3 Accessories:
 - .1 Roof underlayment membrane: SBS modified bitumen, self adhesive, non-woven glass fiber mat, sanded on top, to ASTM D1970.
 - .2 Roof Flashings: 24 gauge, colour to match roofing, size and profile as shown on Drawings.

2.2 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB-37.5.
- .3 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer.
- .4 Cleats: of same material, and temper as sheet metal:50 mm minimum wide.
 - .1 Thickness 3 mm minimum.
- .5 Fasteners: screws to CSA B35.3. Purpose made hot dipped galvanized coated steel, exposed.
- .6 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.3 FABRICATION

- .1 Design roof assembly components and fasteners for local wind loads.
- .2 Provide for movement of components without causing buckling, failure of joint seals, undue stress of fasteners when subject to seasonal temperature range from -40C to +50C.
- .3 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.
- .4 Hem exposed edges on underside 12 mm, mitre and seal.
- .5 Form sections square, true and accurate to size, free from distortion and other

defects detrimental to appearance or performance.

- .6 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

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 sheet metal 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 INSTALLATION

- .1 Use concealed fastenings except where approved in writing by Departmental Representative before installation.
- .2 Include underlay under sheet metal roofing.
 - .1 Secure in place and lap joints 100 mm minimum.
- .3 Install sheet metal roof panels using cleats spaced at 300 mm maximum on centre or manufacturer's instructions.
- .4 Secure cleats with 2 fasteners each and cover with cleat tabs.
- .5 Stagger transverse seams in adjacent panels.
- .6 Flash roof penetrations with material matching roof panels, and make watertight.
- .7 Form seams in direction of water-flow and make watertight.

3.3 CLEANING

- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 74 21 - Waste Management Disposal
- .3 Section 01 45 00 - Quality Control
- .4 Section 06 10 10 - Rough Carpentry
- .5 Section 06 17 56 - Plate-Connected Roof Trusses
- .6 Section 07 44 46- Mineral Fiber Cementitious Siding
- .7 Section 07 92 00 - Joint Sealants
- .8 Section 08 11 00 - Metal Doors and Frames

1.2 REFERENCES

- .1 The Aluminum Association Inc. (AAI)
 - .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.
 - .2 AAI DAF45-03, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .3 Canadian Roofing Contractors Association (CRCA)
- .4 Canadian General Standards Board (CGSB)
- .5 Canadian Standards Association (CSA International)
 - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.
 - .3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data, shop drawings and samples in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.

Part 2 Product

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: 0.70 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.
- .2 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 33 with AZ150 coating, extra smooth surface, not chemically treated for paint finish, 0.61 mm base metal thickness.
 - .1 Colour: chosen from manufacturer's standard stock of colours. To match adjacent material colour.
- .3 Trim Items: Metal flashings and trim shall be factory or field formed from the same material, gauge and finish as the roofing panels.

2.2 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
- .3 Underlay for metal flashing: SBS bitumen membrane, self-adhered.
- .4 Sealants: Low VOC sealants as recommended by Metal-Span Rollforming Corp.
- .5 Hexhead fasteners: CSA B111. Screws: ANSI B18.6.4. Purpose made aluminum alloy, cadmium plated steel. Screw head colour to match cladding material.
- .6 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness 0.9 mm.
- .7 Fasteners: of same material as sheet metal, to CSA B111, non-corrosive screws of length and thickness suitable for metal flashing application.

- .8 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .9 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.
- .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.

2.4 METAL FLASHINGS

- .1 Form flashings, copings and fascias to profiles indicated of 0.61mm thick galvanized steel.
- .2 Trim items: Metal flashings and trim shall be factory or field formed from the same material, gauge and finish as the roofing panels.

Part 3 Execution

3.1 INSTALLATION

- .1 Install sheet metal work, for both new and existing Services Building in accordance with manufacturer's printed instructions and industry standards.
- .2 Use concealed fastenings except where approved before installation.
- .3 Install pre-finished metal over fascias to cover exposed wood.
- .4 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.
- .5 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
 - .1 Flash joints using S-lock forming tight fit over hook strips, as detailed.
- .6 Lock end joints and caulk with sealant.

- .7 Install surface mounted reglets true and level, and caulk top of reglet with sealant.

3.2 EAVES TROUGHS AND DOWNPIPES

- .1 Install eaves troughs and secure to building at 750 mm on centre with appropriate non-corrosive straps and fasteners.
 - .1 Slope eaves troughs to downpipes as indicated.
 - .2 Seal joints watertight.
- .2 Install downpipes and provide goosenecks back to wall.
 - .1 Secure downpipes to wall with straps at 1220 mm on centre; minimum two straps per downpipe.
 - .2 Direct downpipes to splashpads..
- .3 Install splash pans as indicated.

3.3 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Fire stop 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 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .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 MSDS - Material Safety Data Sheets .
- .3 Shop Drawings:

- .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
- .2 Construction details should accurately reflect actual job conditions.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: person specializing in fire stopping installations with documented experience.

1.5 SEQUENCING AND SCHEDULING

- .1 Sequence works to permit installation of the fire stopping and smoke seal materials after adjacent work is complete and before closure of spaces.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling, unloading and storing:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse in accordance with Section 01 74 21 - Waste Management and Disposal.

Part 2 Product

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 .
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115 and listed in ULC Guide No.40 U19.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.
- .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.
 - .1 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 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.
- .6 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .7 Maintain integrity of fire separation.
- .8 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.6 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 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 gypsum board partitions and walls.
 - .2 Top of fire-resistance rated gypsum board partitions.
 - .3 Intersection of fire-resistance rated gypsum board partitions.
 - .4 Control and sway joints in fire-resistance rated gypsum board partitions and walls.
 - .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.

- .8 Rigid ducts: greater than 129 cm² : 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 OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 61 00 - Product Requirements.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
 - .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .2 General Services Administration (GSA) - Federal Specifications (FS)
 - .1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
 - .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 2 copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3 Manufacturer's Instructions:
 - .1 Submit instructions to include installation instructions for each product used.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

1.5 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Proceed with installation of joint sealants only when:
 - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
 - .2 Joint substrates are dry.
 - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
 - .2 Joint-Width Conditions:
 - .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.
 - .3 Joint-Substrate Conditions:
 - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 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 Material Safety Data Sheets (MSDS) acceptable to Health Canada.

- .2 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

Part 2 Product

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 off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .3 Where sealants are qualified with primers use only these primers.
- .4 Sealants and caulking compounds must:
 - .1 meet or exceed all applicable governmental and industrial safety and performance standards; and
 - .2 be manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by laws and regulations including, for facilities located in Canada, the fisheries Act and the Canadian Environmental Protection Act (CEPA).
- .5 Sealant and caulking compounds must not be formulated or manufactured with: aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, barium or their compounds, except barium sulfate.
- .6 Sealant: not containing a total of volatile organic compounds in excess of 5% by weight, asbestos-free sealant, compatible with systems materials and as recommended by system manufacturer. Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this section.
- .7 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.
- .8 In the selection of the products and materials of this section preference will be given to those with the following characteristics: Water based, water soluble, water clean-up, non-flammable, Biodegradable, low Volatile Organic Compound (VOC) content, manufactured without compounds which

contribute to ozone depletion in the upper atmosphere, manufactured without compounds which contribute to smog in the lower atmosphere, does not contain methylene chloride, does not contain chlorinated hydrocarbons.

- .9 The manufacturing process must adhere to Lifecycle Assessment Standards as per ISO 14040/14041 LCA Standards (to be published by 1998), CSA Z760-94 LCA Standards.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.
 - .1 Sealant Type 1: silicone base, one part moisture curing sealant to CAN 2-19.13-M82. colour to be selected: to be used with joint back-up bond breaker and primer. Acceptable product Dow Corning 790.
 - .2 Sealant Type 2: silicone base, one component, to CAN 2-19.18-M82 solvent curing, white paintable. Acceptable product Dow Corning 8644 paintable sealant.
 - .3 Sealant Type 3: silicone base, one part mildew and fungus resistant, to CAN/CGSB-19.22-M89. Acceptable product Dow Corning 786 mildew resistant sealant.
 - .4 Sealant Type 4: Silicone base, one component to CAN/CGSB-19.22-M89 acoustic sealant and bedding compound. Acceptable product Tremco acoustic sealant.
 - .5 Sealant Type 5: Urethanes two part, self-levelling: to CAN/CGSB-19.24, Type 1, Class B, colour to match surface, from manufacturer's standard range.
 - .6 Sealant Type 6: Acoustic sealant, non-shrinking, non-hardening, single component, synthetic rubber sealant, conforming to CAN/CGSB-19.21 M (current edition).
 - .7 Colours to be selected from the standard manufacturer's range.
- .2 Preformed compressible and non-compressible back-up materials:
 - .1 Polyethylene, urethane, neoprene or vinyl foam:
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 High density foam:
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³

density, or neoprene foam backer, size as recommended by manufacturer.

- .3 Bond breaker tape:
 - .1 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 , exterior joints between dissimilar materials: sealant type: 1.
- .2 Seal interior perimeters of exterior openings as detailed on drawings: sealant type: 2.
- .3 Interior control and expansion joints in floor surfaces: sealant type: 5.
- .4 Perimeters of interior frames, as detailed and itemized: sealant type: 2.
- .5 Exposed interior control joints in drywall: sealant type: 2.

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.
- .2 Primer: in accordance with sealant manufacturer's written 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 joint sealants 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 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.3 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.

3.4 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.

3.5 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.

3.6 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.7 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.

3.8 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Clean adjacent surfaces immediately.
 - .3 Remove excess and droppings, using recommended cleaners as work progresses.
 - .4 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

3.9 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Section 07 92 00 - Joint Sealing
- .3 Section 08 71 10 - Door Hardware
- .4 Section 09 91 99 - Painting for Minor Works

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .3 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
- .4 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 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 -45 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.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide product data: in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.

- .2 Provide shop drawings: in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province s of British Columbia, Canada.
 - .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, louvred, arrangement of hardware and finishes.
 - .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings reinforcing finishes.
 - .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
 - .5 Submit test and engineering data, and installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.

Part 2 Product

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Composites: balance of core materials used in conjunction with lead: in accordance with manufacturers' proprietary design.

2.2 DOOR CORE MATERIALS

- .1 Honeycomb construction:
 - .1 Structural small cell, 20.0 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.
 - .2 Stiffened: face sheets laminated, honeycomb core.
 - .3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees C at 30 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

- .4 Exterior Doors: Bonded core: urethane or isocyanurate board insulation to CGSB 51-GP-21M, bonded to door skins, with no metal to metal contact except at edges.

- .1 Polyurethane: to CAN/ULC-S704-2001 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m³.

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

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 99 - Painting for Minor Works, . 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 caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Door bottom seal: Refer to Section 08 71 10 - Door Hardware.
- .4 Metallic paste filler: to manufacturer's standard.
- .5 Sealant: Refer to Section 07 92 00 - Joint Sealants.
- .6 Sprayfoam insulation: Canister type sprayfoam. Acceptable product: Frothpak foam FPR by Dow Chemical.
- .7 Glazing units: flat glass, laminated, 6 mm thickness.

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: 1.2 mm welded type construction.
- .4 Interior frames: 1.2 mm welded type construction.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .6 Protect mortised cutouts with steel guard boxes.
- .7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .8 Manufacturer's nameplates on frames and screens are not permitted.
- .9 Conceal fastenings except where exposed fastenings are indicated.
- .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .11 Insulate exterior frame components with sprayfoam 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, transom bars, 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.
- .7 Securely attach lead to inside of frame profile from return to jamb soffit

(inclusive) on door side of frame only.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for door hardware.
- .2 Exterior doors: honeycomb construction. Interior doors: honeycomb construction.
- .3 Fabricate doors with longitudinal edges locked seam. Seams: visible.
- .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM .
- .5 Blank, reinforce, drill doors and tap for mortised, templated 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 PVC 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 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel with core laminated under pressure to face sheets.
- .2 Form face sheets for interior doors from 1.6 mm sheet steel with core laminated under pressure to face sheets.

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 spray-foam insulation to door frame.

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 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 / vapour barrier.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds .
- .3 Adjust operable parts for correct function.

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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 77 00 - Closeout Procedures.
- .3 Section 08 11 00 - Metal Doors and Frames.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.4-2000, Door Controls - Closers.
 - .3 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.
 - .4 ANSI/BHMA A156.6-2005, Architectural Door Trim.
 - .5 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.
 - .6 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.
 - .7 ANSI/BHMA A156.18-2006, Materials and Finishes.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .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 Hardware List:
 - .1 Submit contract hardware list in accordance to Section 01 33 00 -

Shop Drawings, Product Data and Samples.

- .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 77 00 - Closeout Procedures.
- .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.
 - .3 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
- .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 in a locked, clean and dry location and in accordance with manufacturer's recommendations .
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Product

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 All hardware listed is Schlage, "A" Series = Standard of Acceptance.
- .2 Hinges: type, number and sizes to suit door application. Use non-removable pins for out swinging exterior doors.
- .3 Lock and Latch sets: Schlage 'A' series with Levon Lever set. 626 Satin chromium plated finish.
 - .1 Locksets: A70PD - Outer lever locked or unlocked by key from outside, inner lever always free.
- .4 Strikes: box type, normal projection.
- .5 Door bottom seal: adjustable sweep and 4- seal door seal of arctic grade vinyl, surface mounted with drip cap and closed ends.
- .6 Threshold/sill: full width of door opening, low profile, aluminum extruded finish, serrated surface, with interlocking lip and related door cap.
 - .1 Maximum vertical height of 1/2" on entry doors.
- .7 Door Closer: Standard of Acceptance: LCN surface mounted "Smoothee", series 4110 cush-n-stop, equipped with hold open arm adjustable from 85 to 100 degrees, equipped with fusible link (where noted), finished in silver bronze lacquer and equipped with all arms and brackets for mounting in over door application. All closers on exterior doors to be climate control type.
- .8 Weatherstripping: Arctic grade neoprene for all exterior doors.
- .9 Fasteners: as required to complete hardware installation, and to match finish of hardware.
- .10 Keying: To requirements of Owner. Co- ordinate with Division 16 for security system provisions.
- .11 Door Cap: manufactures end seal for all hollow steel doors.

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 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 Doors, padlocks and cabinet locks to be keyed alike in groups. Prepare detailed keying schedule in conjunction with Departmental Representative.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply 2 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply construction cores.
- .6 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 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 CSDFMA 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:
 - .1 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .2 Remove protective material from hardware items where present.
 - .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by door hardware installation.

3.5 SCHEDULE

Hardware Group # 1 (Dr # 100.1, 103.1, 104.1, 105.1)

3	ea.	Hinges	LH1391CB114 X 101mm X NRP	630
1	ea.	Storeroom Lock	LH8720 x LH11	630
1	ea.	Door Closers	8016-CSA-40	689
1	ea.	Kickplates	GSH80A-254 x D.W.	630
1	set	Weatherstrip	DS130 1/D.W. 2/D.H.	627
1	ea.	Door Bottoms	DS138 x D.W.	627
1	ea.	Threshold	DS6001 TBA x D.W.	627

Hardware Group # 2 (Dr # 102.1)

6	ea.	Hinges	LH1399CB 114 x 101mm NRP	630
1	ea.	Lockset	LH8713-L11	626
2	ea.	Flush Bolts	GSH401	626
2	ea.	Door Closers	LH816DA-LHCHSTH 825	689
1	ea.	Coordinator	LHSMC-52 w/Fillers Brackets	600
1	set	Weatherstrip	DS130 1/D.W. 2/D.H.	627
1	ea.	Door Bottoms	DS138 x D.W.	627
1	ea.	Threshold	DS6001 TBA x D.W.	627
1	ea.	Astragal	DS188 x D.H.	627

Hardware Group # 3 (Dr #, Single & Double Chain Gates)

- Complete by Door Supplier

Hardware Group # 4 (Dr # 101.1)

3	ea.	Hinges	LH1379CB 114 x 101mm	652
1	ea.	Storeroom Set	LH5007L	626
1	ea.	Door Closer	LH816DA-LHCHST 825	689
1	ea.	Kickplate	80A-10 x D.W.	630

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 01 74 19 - Waste Management and Disposal
- .3 Section 06 10 10 - Rough Carpentry
- .4 Section 07 21 16 - Blanket Insulation
- .5 Section 07 84 00 - Fire Stopping
- .6 Section 07 92 00 - Joint Sealants
- .7 Section 08 11 00 - Metal Doors and Frames
- .8 Section 09 91 99 - Painting for Minor Works

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C475-02(2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C840-08, Standard Specification for Application and Finishing of Gypsum Board.
 - .3 ASTM C1002-07, 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.
- .2 Canadian General Standards Board (CGSB)
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
- .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 level off ground 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.

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 minimum after 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 Product

2.1 MATERIALS

- .1 Standard board: to ASTM C1396/C1396M Type X, 15.9 mm thick, or Regular, 12.7mm thick, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.
- .2 Abuse Resistant Gypsum Board: to ASTM C 1396, Type X, 15.9mm thick, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.
- .3 Metal furring runners, resilient metal channels, hangers, tie wires, inserts, anchors: to ASTM A653M, Z180 Zinc coating.
- .4 Steel drill screws: to ASTM C1002.
- .5 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, ABS, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .6 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

- .1 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .7 Polyethylene: to CAN/CGSB-51.34, Type 2.
- .8 Insulating strip: rubberized, moisture resistant, 3 mm thick cork strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .9 Joint compound: to ASTM C475, asbestos-free.

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 Install work level to tolerance of 1:1200.
- .4 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles .
- .5 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .6 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.
- .7 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

- .8 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Apply single layer gypsum board to metal furring or framing using screw fasteners, screw fasteners. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 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 layers at right angles to supports unless otherwise indicated.
 - .3 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 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.
 - .4 Install gypsum board on walls vertically to avoid end-butt joints. At high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
 - .5 Install gypsum board with face side out.
 - .6 Do not install damaged or damp boards.
 - .7 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.
- .2 Install casing beads where gypsum board butts against surfaces having no

- trim concealing junction and where indicated. Seal joints with sealant.
- .3 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
 - .4 Splice corners and intersections together and secure to each member with 3 screws.
 - .5 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
 - .6 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.
 - .7 Gypsum Board Finish: finish gypsum board walls to following levels in accordance with AWCI Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .2 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.
 - .8 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.
 - .9 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.
 - .10 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
 - .11 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
 - .12 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
 - .13 Mix joint compound slightly thinner than for joint taping.
 - .14 Apply thin coat to entire surface using trowel or drywall broad knife to fill

surface texture differences, variations or tool marks.

- .15 Allow skim coat to dry completely.
- .16 Remove ridges by light sanding or wiping with damp cloth.

3.5 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Waste Management: separate waste materials for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

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.

3.7 SCHEDULES

- .1 Construct fire rated assemblies to NBC assemblies criteria and where indicated on drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 01 33 00 - Shop Drawings, Product Data and Samples
- .2 01 45 00 - Quality Control
- .3 01 61 00 - Product Requirements
- .4 01 74 19 - Waste Management and Disposal
- .5 01 77 00 - Closeout Procedures

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.
- .4 Certificates: 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 - Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store painting materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.
- .3 Fire Safety Requirements:
 - .1 Supply 1 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 National Fire Code of Canada requirements.

1.5 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces in accordance with Section
 - .2 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
 - .2 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.
- .3 Additional application requirements:
 - .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.

Part 2 Product

2.1 MATERIALS

- .1 Supply paint materials for paint systems from single manufacturer. Provide three coats of paint for a premium grade finish.
- .2 Qualified products: only paint materials listed on the MPI Qualified Products List are acceptable for use on this project.
- .3 Conform to latest MPI requirements for painting work including preparation and priming.
- .4 Low odour products. Whenever possible, select products exhibiting low odour characteristics. If two products are otherwise equivalent, select the product with the lowest odour.
- .5 Colours:
 - .1 Submit proposed Colour Schedule to Departmental Representative for review.
 - .2 Base colour schedule on selection of 2 base colours and 1 accent colours.
 - .3 Selection of colours will be from manufacturer's standard range of colours.
- .6 Mixing and tinting:
 - .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Departmental Representative for tinting of painting materials.
 - .2 Use and add thinner in accordance with paint manufacturer's recommendations.
 - .1 Do not use kerosene or similar organic solvents to thin water-based paints.
 - .3 Thin paint for spraying in accordance with paint manufacturer's written recommendations.
 - .4 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.
- .7 Gloss/sheen ratings:
 - .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss Level-Category	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish	Max. 5	Max. 10
Gloss Level 2 - Velvet	Max.10	10 to 35
Gloss Level 3 - Eggshell	10 to 25	10 to 35
Gloss Level 4 - Satin	20 to 35	min. 35
Gloss Level 5 - Semi-Gloss	35 to 70	
Gloss Level 6 - Gloss	70 to 85	
Gloss Level 7 - High Gloss	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated.
- .8 Exterior painting:
 - .1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.
 - .1 EXT 5.1D - Alkyd Gloss Level 5 finish.
 - .2 Galvanized Metal: high contact/high traffic areas (doors, frames, railings and handrails, etc.).
 - .1 EXT 5.3B - Alkyd Gloss Level 6 finish.
 - .3 Dressed Lumber: doors, door and window frames, casings, battens, smooth facias, etc.
 - .1 EXT 6.3B - Alkyd Gloss Level 6 finish do not use flat finish on doors.
- .9 Interior painting:
 - .1 Concrete horizontal surfaces: floors.
 - .1 INT 3.2B - Alkyd floor enamel low gloss finish.
 - .2 Galvanized Metal: high contact/high traffic areas (doors, frames, railings and handrails, etc.).
 - .1 INT 5.3C - Alkyd Gloss Level 6 finish (over cementitious primer).
 - .3 Dressed Lumber: doors, door and window frames, casings, mouldings, etc.:
 - .1 INT 6.3B - Alkyd Gloss Level 6 finish.
 - .4 Gypsum board: gypsum wallboard, drywall, "sheet rock" type material, etc.
 - .1 INT 9.2A - Latex semi-gloss level 5 finish (over latex sealer).

- .5 Plywood backboards for electrical equipment:
 - .1 INT 6.4P - Pigmented fire retardant (ULC rated), gloss level 7.

Part 3 Execution

3.1 GENERAL

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual except where specified otherwise.

3.2 EXAMINATION

- .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.

3.3 PREPARATION

- .1 Protection of in-place conditions:
 - .1 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .2 Protect factory finished products and equipment.
- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.
 - .3 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual specific requirements and coating manufacturer's recommendations.
 - .4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat

is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

- .5 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.
- .6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.
- .7 Touch up of shop primers with primer as specified.

3.4 APPLICATION

- .1 Paint only after prepared surfaces have been accepted by Departmental Representative
- .2 Use method of application approved by Departmental Representative.
 - .1 Conform to manufacturer's application recommendations.
- .3 Apply coats of paint in continuous film of uniform thickness.
 - .1 Repaint thin spots or bare areas before next coat of paint is applied.
- .4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .5 Sand and dust between coats to remove visible defects.
- .6 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
- .7 Mechanical/Electrical Equipment:
 - .1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
 - .2 Do not paint over nameplates.
 - .3 Paint fire protection piping red.
 - .4 Paint natural gas piping yellow.
 - .5 Paint both sides and edges of backboards for telephone and electrical equipment before installation.
 - .1 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.5 CLEANING

- .1 Waste Management: separate waste materials for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Place primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 10-2013, Standard for Portable Fire Extinguishers.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Product

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

- .1 Cartridge operated type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
 - .1 Size 9 kg or as indicated.

2.2 EXTINGUISHER BRACKETS

- .1 Type recommended by extinguisher manufacturer.

2.3 EXTERIOR OUTDOOR COVERS

- .1 High visibility, heavy duty acrylic coated polyester with hook and loop closures.
- .2 Size to be suitable for extinguisher.
- .3 Provide for extinguishers mounted exterior to the building where indicated on drawings.

2.4 IDENTIFICATION

- .1 Identify extinguishers in accordance with recommendations of CAN/ULC-S508.
- .2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

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 or mount extinguishers in cabinets or on brackets as indicated.

END OF SECTION

Part 1 General

1.1 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- .1 Faucets, tail pieces, strainers, traps, electrical outlets, non-integral sinks and drains.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 01 45 00 - Quality Control
- .3 01 61 00 - Product Requirements
- .4 01 77 00 - Closeout Procedures
- .5 06 10 10 - Rough Carpentry
- .6 09 21 16 - Gypsum Board Assemblies

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 CSA International
 - .1 CSA O112.10-08, Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data, shop drawings and samples in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 stainless steel countertop and shelves from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer of crates, as specified in Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Product

2.1 MATERIALS

- .1 Stainless steel sheet: to ASTM A167, Type 304, with No. 3 finish.
- .2 Plywood core: PS 1, exterior type, veneer grade AC, sanded faces, 19 mm thickness.
- .3 Steel support brackets:
- .4 Sealants: to SCAQMD Rule 1168.

2.2 COUNTERTOP FABRICATION

- .1 Fabricate countertop splashbacks as indicated.
- .2 Fabricate countertop and splashback sections in as long a length as practicable.
- .3 Cut holes for fittings, accessories, and equipment.
- .4 Round or chamfer exposed edges and corners of cutouts.
- .5 Form countertops of 1.65 mm thick (16 GA) stainless steel sheets with edges returned as indicated.
- .6 Connect steel support brackets to walls with bolts. Provide blocking to suit.
- .7 Apply metal tops to 19 mm plywood core using contact adhesive.
- .8 Finish exposed edges and surfaces in same manner as specified for working surface of countertop material.
- .9 Make allowances around periphery and where fixed objects pass through or project into countertop material to permit normal movement without restriction.
- .10 Joints: field welded or mechanical watertight.

2.3 SINK

- .1 Stainless steel sinks: to ASTM E54 and ASTM E478, 1.4 mm, type 304 stainless steel, welded construction without solder or fill, exposed surface polished No. 4 finish.
 - .1 Use self rimming, flush mounted stainless steel sinks occurring in tops other than stainless steel. Include hold down brackets for self rimming sinks. Refer to Section 22 42 00.

2.4 ELECTRICAL FITTINGS

- .1 Electrical outlets: to applicable standards and CSA approval. Refer to Division 26 for specific requirements.
 - .1 Boxes for flush mounted outlets: of sufficient size, with galvanized finish.
 - .2 Receptacles 15A, 125V 2P3W standard blade configuration, grounded.
 - .3 Cover plates: No. 4 finish stainless steel.

2.5 SHELVES

- .1 Form shelves of steel sheet with front, side and rear edges flanged down 19 mm and hemmed back at 30 degrees to underside of shelf.
- .2 Support shelves with steel brackets attached to shelf base and into wall. Provide blocking as required.

2.6 FINISHING

- .1 Grind and polish spot weld marks from exposed surfaces.

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 steel laboratory casework 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 countertops level to 1.5 mm in 3 m.
- .2 Fit closure strips and scribe to irregularities of adjacent surfaces, maximum gap opening 0.5 mm.
- .3 Support wall shelves by bolting directly to wall.
- .4 Apply small bead of sealant at junction of countertop and adjacent wall finish.

3.3 CLEANING

- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment .
 - .1 Touch up marred or abraded finished surfaces.
 - .2 Wipe down surfaces to remove fingerprints and markings.
- .2 Waste Management: separate waste materials for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by steel countertop and shelf installation.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This section refers to the supply, delivery, installation and on-site inspection of 12% Sodium Hypochlorite Solution (NaOCl) chemical feed systems, free chlorine analyzer, and static mixers.

1.2 INCLUDED ITEMS

- .1 The following items shall be included in this section and shall be supplied by one manufacturer.
 - .1 One (1) skid mounted 12% Sodium Hypochlorite Solution (NaOCl) dosing package (CL-01/02), complete with accessories listed in this specification. The pumps shall be NSF61 certified. The package shall have two peristaltic tube pumps per skid, one-duty, and one-standby with automatic switch-over control. CFS pump package panel, to mount the two pumps with accessories including flow indicator, 100 ml self-fill calibration column, isolating valve, check valve, pressure relief valve, pulsation damper, container basins and pressure gauge, pre-assembled, pre-piped, pre-tested and wired. One common spare pump shall be provided separately and handed over to the Departmental Representative.
 - .2 One (1) Polyethylene (PE) 145-litre open-top with lid, storage tank for 12% sodium hypochlorite solution.
 - .3 One (1) inline static mixers of 316SS construction and one (1) chemical additive ports.

1.3 DESIGN CRITERIA

- .1 The materials and equipment covered by this specification are intended to be standard equipment of proven ability as manufactured by reputable vendors. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry, and shall operate satisfactorily when installed in accordance with manufacturer's recommendations and the Contract Documents. The specifications call attention to certain features, but do not purport to cover all details entering into the construction of the equipment.

Tag Number	CL-01/CL-02
Application	Post-Chlorination
Liquid	12% NaOCl solution
Temperature (deg C)	5
Specific gravity	1.15
Chemical conc. (%)	12
Capacity (L/h)	0 - 0.13

Maximum pressure (kPa)	860
Pump drive type	Motor
Power supply	120V/1ph/60Hz

1.4 REQUIREMENTS

- .1 The treatment system shall be furnished by a single manufacturer who shall:
 - .1 Furnish proof of successful operating experience during the last five (5) years on installations comparable to that specified herein.
 - .2 Where major components of another manufacturer are proposed to be used, engage and pay for the services of a qualified service engineer of that manufacturer for the purposes of ensuring proper installation, adjustment, and placement into service.
 - .3 Provide chemical feed system completely plumbed and wired at the factory with all interconnecting plumbing headers and wiring bundles prefabricated for easy installation in the field.
 - .4 Accept responsibility for satisfactory operation of the entire chemical feed system and equipment.
 - .5 Guarantee for two (2) years from the date of acceptance that all equipment is free from defects in design, materials and workmanship. Furnish replacement parts for any defective component at no additional cost.

1.5 COORDINATED SYSTEM

- .1 It is the intention of these specifications that the chemical feed systems specified in this section shall be furnished as part of a coordinated system supplied by a single manufacturer so that undivided responsibility for a complete and operating system is assured.
- .2 The chemical feed equipment supplier shall submit to the Departmental Representative four (4) complete sets of shop drawings, details, data sheets and other descriptive drawings and material as may be required to fully describe the equipment proposed and verify compliance with the contract documents.

Part 2 Products

2.1 EQUIPMENT DESCRIPTIONS

- .1 Peristaltic pumps
 - .1 Pumps shall be microprocessor controlled tube-type peristaltic pumps, consisting of corrosion resistant NEMA 4X enclosure, integral brushless variable speed motor, overhung motor shaft, plastic rotor, tubing and protective cover. Pump shall be NSF 61

- certified for drinking water applications.
- .2 Pump shall be able of operating in either direction without output variation. Pump shall be capable of running dry without damage.
 - .3 Turndown capability of pump to be 10,000:1.
 - .4 Rotor:
 - .1 Squeeze rollers with encapsulated ball bearings shall be directly coupled to a one piece thermoplastic rotor. Four polymeric rollers shall be provided; two squeeze rollers for tubing compression shall be located 180 degrees apart and two guide rollers that do not compress the tubing shall be located 180 degrees apart. The roller diameters and occlusion gap shall be factory set to provide the optimum tubing compression; field adjustment shall not be required.
 - .2 Spring loaded or hinged rollers shall not be used.
 - .3 Rotor assembly shall be installed on a D-shaped, chrome plated motorshaft and removable without tools.
 - .5 Tubing:
 - .1 Fabricated of Norprene elastomer, suitable for prolonged exposure to 12% sodium hypochlorite solution. Tubing to be fabricated with 1/2"MNPT connection for connection to piping systems.
 - .6 Incorporate a counter of the number of revolutions since last counter reset. The counter shall alarm when the setpoint number of revolutions have passed.
 - .7 Product shall have integral Tube Failure Detection (TFD) system, which protects the pump by automatic stopping operating in the event of liquid detection within the pump head.
 - .8 Protective cover must be removed for replacement of tubing. For personnel protection, the pump shall detect removal of cover using a magnetic interlock, and automatically reduce pump operating speed to that required for tubing replacement.
 - .9 Pump shall be microprocessor controlled. Provide the following functionality on a local display / keypad:
 - .1 Display and adjustment of dosing rate (in percent, rpm, L/h);
 - .2 Display number of revolutions;
 - .3 Indication of external mode;
 - .4 Pump priming;
 - .5 Rotation direction reversal;

- .6 Access code to prevent unauthorized adjustments to pump.
- .10 Control Functionality – Inputs:
 - .1 4-20 mA, 0-10VDC, frequency or pulse batch flow input signal. Pump to have slope feature, such that dosing rate at minimal and maximum analog signals may be customized. Analog to digital converters external to the pumps are not acceptable.
 - .2 Remote start-stop.
- .11 Outputs
 - .1 4-20 mA or frequency output, for current feed rate.
 - .2 Four (4) configurable relay outputs, configurable to activate on different pump conditions, including: general alarm, TFD trigger, current operating mode, revolution alarm, reversal alarm, loss of input / output signals.
- .2 Chemical Feed Skid Package
 - .1 Provide pre-plumbed skids for peristaltic pumps. The pump manufacturer shall be responsible for design and assembly of the pump skid.
 - .2 A total of one (1) pump skids are required under this Section.
 - .3 Pump skids shall be fabricated of welded aluminum, with polyester powder coating for chemical resistance.
 - .4 Any tubing present on skid shall be braided PVC flexible tubing.
 - .5 Include the following components in each skid package.
 - .1 Peristaltic tube metering pumps.
 - .2 Accessories:
 - .1 Adjustable PVC pressure relief valve for each pump.
 - .2 Common PVC self-fill calibration column, minimum 500 mL capacity.
 - .3 PVC / Viton adjustable pressure relief valve, 0 – 150 psi.
 - .4 316 stainless steel pressure gauge with diaphragm seal, 2” face.
 - .5 Schedule 80 PVC socket welded pipes and fittings.
 - .6 Schedule 80 PVC isolation valves.
 - .7 Drip tray.

- .6 Automatic switchover junction box
 - .1 Provide one (1) junction box for each skid, loose supply for Contractor installation and wiring.
 - .2 On failure of the operating pump (pump output relay fail-open), the junction box shall immediately activate and switch over to use the standby pump to satisfy the chemical dosing requirements. This shall function independent of the Plant control system.
- .7 Provide the following accessories as loose supply:
 - .1 Two (2) injection quills, each of the following:
 - .1 19 mm (3/4") NPT brass corporation cock
 - .2 Brass solution tube adaptor
 - .3 Brass packing nut and 300 series O-ring
 - .4 SS safety chain restraint
 - .5 3/8" PVC Schedule 80 solution tube (to extend 1" past the corpstop)
 - .6 PVC spring loaded ball check valve (includes Hastelloy C spring, Teflon ball and Viton seat)
- .3 Tanks
 - .1 Provide one (1) 145-litre PE solution tank, open top with lid, for storage of sodium hypochlorite. Dimensions: 450 mm DIA x 1000 mm H (18"x 40").
 - .2 Provide 25 mm (1") bulkhead fittings for the tank.
 - .3 Ball Valve
 - .1 Unless otherwise specified, all chemical solution line valves 80 mm and smaller shall be 1,050 kPa ball type, thermoplastic PVC with Viton seals, socket type.
 - .4 The tank to be fitted with a single low level alarm switch. The switch to be mounted to provide a low level alarm signal at a point where 20% of useable tank volume is still available to be delivered by the respective pump system. Alarm switches to be of a mechanical float type. Switches are to be manufactured of materials that are compatible with the chemicals within the storage tanks.
- .4 Spill Containment and Ramp
 - .1 Provide two (2) 6-drum accumulation centres (1852 mm x 1245 mm x 140 mm) with 276 Litre sump capacities. Provide sump to sump drain kit (including joining clips and transfer tube) to allow centres to be joined together on-site to achieve a continuous sump.

- .2 Provide two (2) portable dock plate.
- .5 Static Mixer
 - .1 Supply and install one (1) removable mixing element.
 - .2 Mixer is to be constructed of 316 stainless steel.
 - .3 Mixer is to be suitable for installation in the 50 mm filtered water line. Flanges are to be ANSI B 16.5 - 150 lbs.
 - .4 Mixer design criteria to be base on min and max water flow rates of 1.26L/s and 3.79L/s and sodium hypochlorite (12%) solution injection rates of 0.01L/h to 0.13L/h.
 - .5 Rated pressure of the mixer is to be minimum 1,034 kPa

Part 3 Execution

3.1 INSTALLATION

- .1 Contractor will supply necessary parts, labour and tools for complete installation of chemical feed package.
- .2 Competent personnel shall install equipment in strict accordance with the manufacturer's instructions. The Contractor will not commence installation until such instructions have been received.

3.2 EQUIPMENT TESTING

- .1 When equipment installation has been completed to the standards required by these specifications, the Contractor shall arrange for the services of the equipment manufacturer's technical representative for a minimum of one (1) day.
- .2 The equipment manufacturer's technical representative shall inspect the installation to ensure that the equipment has been installed in accordance with the manufacturer's requirements. If the installation is not in order, the contractor shall correct the deficiencies identified by the manufacturer's representative. The manufacturer's representative shall advise the Departmental Representative in writing that the installation has been checked, and has been installed in accordance with the manufacturer's requirements.
- .3 The cost of the equipment manufacturer's representative shall be borne by the Contractor.

3.3 FINAL INSPECTION

- .1 The Departmental Representative shall make final inspection only after the manufacturer's representative has advised the Departmental Representative in writing that the system may be operated.
- .2 The Contractor will, at its own expense, repair any irregularities or discrepancies identified during the examination. Costs associated with additional trips required by the manufacturer's representative for re-

testing due to faulty installation shall be borne by the Contractor.

3.4

TRAINING

- .1 In addition to the time provided for equipment testing, the Contractor shall provide for a minimum of eight (8) hours of on-site, formal training. The training shall cover all aspects of operation and maintenance of the equipment.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00: Submittals.
- .2 Indicate:
 - .1 Equipment including connections, piping, and fittings, and ancillaries, identifying factory and field assembled.
 - .2 Factory tested and certified performance and efficiency pump curves.
 - .3 Wiring as assembled and schematically.
 - .4 Dimensions, construction details and recommended installation.

Part 2 Products

2.1 DW PRESSURE PUMPS

- .1 Multistage convertible self-priming centrifugal pumps, axial suction port and radial discharge ports. End suction, top discharge arrangement and .
- .2 Construction: stainless steel, mechanical shaft seal, technopolymer impellers, Ceramic-Carbon bellows mechanical seal
- .3 Motor: with automatic overload protection.
- .4 Capacity: as noted on drawings schedule

Part 3 Execution

3.1 INSTALLATION

- .1 Make piping, electrical and control connections to pump and motor assembly as indicated on drawings.
- .2 Set up and adjust controls.
- .3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
- .4 Check rotation prior to start-up.
- .5 Install pressure gauge test cocks.
- .6 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.
- .7 Pipe drain tapping to floor.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 23 05 01 - Installation of Pipework
- .2 Section 22 11 18 - Domestic Water Piping
- .3 Section 31 23 33.01 - Excavating, Trenching, and Backfilling

1.2 REFERENCES

- .1 ASTM A 307-2 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittals.

Part 2 Products

2.1 BURIED WATER SERVICES LINES

- .1 Polyethylene (HDPE) pressure pipe & fittings:
 - .1 To ASTM F714, ASTM D-1248, & CSA B137.1.
 - .2 The pipe shall be made from polyethylene resin compound qualified as Type III, Category 5, Class C, Grade P34 in ASTM D-1248.
 - .3 The raw material shall contain a minimum of 2%, well dispersed, carbon black.
 - .4 Normal requirements is for thermal butt-fusion.
 - .5 Polyethylene to polyethylene joints: proprietary electro fusion. Use continuous run length from connection to existing piping to building, to ASTM D2657.
 - .6 Pressure rating:
 - .1 Carrier pipe: 160psig at 73degF.
 - .7 Series:
 - .1 Carrier pipe: DR 11.
- .2 Insulation:
 - .1 Density: 2lb/ft³ minimum ASTM D1622
 - .2 Closed cell content: 90% minimum ASTM D2856
 - .3 Water absorption: 4.0% by Volume ASTM D2842-69
 - .4 Thermal conductivity: 0.023W/m @ 22 degrees Celsius, ASTM C518
 - .5 Dimensional stability: 3% ASTM D2126-B, E

- .6 Compressive strength: modified ASTM D1621 with 50 mil Jacket, Approximately 60 to 80psi.
- .7 Thickness: minimum 2".
- .3 Jacket:
 - .1 High-density polyethylene UV inhibited factory applied, for cold weather properties (to -45degF) by continuous extrusion or approved tape-wrap method
 - .2 Sealant: butyl rubber & resin
 - .3 Tensile strength" 3045psi minimum to ASTM D1000
 - .4 Thickness: 0.045" minimum for extruded polyethylene or two (2) cross wraps, for a totalminimum thickness of 0.05" for tape-wrapped polyethylene application.
- .4 Fabrication:
 - .1 Pipe shall be located at the centre of the insulation material. An allowable tolerance on this specification is as follows:
 - .1 Total diameter of insulation pipe structure shall in no instance be less than the pipe diameter plus 4".
 - .2 The minimum thickness of insulation at any location of the pipe shall be 2".
 - .3 Provide extruded molding adheared to pipe to serve as conduit for heat tracing. Molding to be adheared to pipe before being insulated.
- .5 Joints:
 - .1 Socket fusion with insulation half shells and heat shrink tape.
- .6 Insulation kits for fittings:
 - .1 Insulation kits for fittings shall consist of rigid polyisocyanurate foam insulation with a fully bonded polymer protective coating on all exterior and interior surfaces, including ends. Kits to be supplied complete with silicone caulking for seams, stainless steel attachment straps and clips, and heat-shrink sleeves or butyl mastic tape to seal between pipe and insulation kit.
 - .2 Rigid polyisocyanurate foam insulation:
 - .1 Density (ASTM D1622) 1.7 to 2 lb/ft3.
 - .2 Compressive strength (ASTM D 1621) 19 to 23 psi.
 - .3 Closed cell content 90% maximum.
 - .4 Water absorption: (ASTM D2842) 4.0% by volume.
 - .5 K factor: (ASTM C 518) 0,027 W/m degC.
 - .6 Thickness, to match pipe insulation thickness.

- .3 Polymer coating:
 - .1 Two component high density polyurethane coating, black in color.
 - .2 Density 73 lb/ft³.
 - .3 Durometer D scale 60.
 - .4 Tensile strength 1600psi.
 - .5 Tear strength 26.5 N/mm
 - .6 Thickness 0.075" outside surfaces, 0.02" inside surfaces.

2.2 BEDDING AND SURROUNDING MATERIALS

- .1 In accordance with Section 22 05 01 - Installation of Pipework.
- .2 Sand, natural or crushed, free of organic matter and graded to following limits:

Sieve Size	Percent Passing By Mass
1	100
2	80-90
0.4	40-55
0.063	2-10

2.3 BACKFILL MATERIAL

- .1 In accordance with Section 31 23 33.01 - Excavating, Trenching, and Backfilling.

2.4 WARNING TAPE

- .1 Polyethylene, 4 mil thick, colour - 'safety precaution blue', wording 'Caution Buried Water Main Below' width 6". One tape required for each service.

2.5 CONCRETE

- .1 For cradles, encasements and supports.

2.6 HEAT SHRINK

- .1 Heat shrink sleeves: One piece cross-linked polyethylene.
- .2 Heat shrinkable tape: 6" wide.

Part 3 Execution

3.1 PIPE WORK INSTALLATION

- .1 Install in accordance with Canadian Plumbing Code and ANSI/NFPA 13, and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 01 - Installation of Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.

3.2 PIPE, FITTINGS & JOINT INSULATION KITS

- .1 Insulation half shells:
 - .1 Installation: stainless steel straps and clips with silicone caulking at all seams.
 - .2 Heat shrink: install heat shrinkable tape in 2 layers. Overlap tape a minimum of 50%. Apply and shrink the first layer before applying the second.

3.3 EXCAVATION

- .1 To requirements of Section 31 23 33.01 - Excavating, Trenching, and Backfilling.

3.4 BEDDING

- .1 To requirements of Section 23 05 01 - Installation of Pipework supplemented as specified herein.
- .2 Cut trenches and place bedding materials in uniform layers not exceeding 6" compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface.
- .4 Shape transverse depressions, as required, to suit joints.
- .5 Compact each layer full width of bed to at least 98% of corrected maximum dry density.

3.5 SURROUND

- .1 To requirements of Section 23 05 01 - Installation of Pipework supplemented as specified herein.
- .2 During and on pipe laying surround and cover pipe.
- .3 Provide for Departmental Representative to inspect work before covering pipe.
- .4 Hand place surround material in uniform layers not exceeding 6" compacted thickness. Do not drop material within 15'-0" of pipe.
- .5 Place layers uniformly and simultaneously on each side of pipe.
- .6 Compact each layer, hand tamped, from pipe invert to mid-height of pipe to at least 98% of corrected maximum dry density.
- .7 Compact each layer, hand tamped, from mid-height of pipe to underside of backfill to at least 98% of corrected maximum dry density.
- .8 Provide a minimum of 12" surround above top of pipe.

3.6 BACKFILL

- .1 To requirements of Section 23 05 01 - Installation of Pipework supplemented as specified herein.
- .2 Place backfill material above pipe surround in uniform layers not

exceeding 12" compacted thickness up to grades as indicated unless otherwise specified.

3.7 PRESSURE TEST

- .1 Test system in accordance with Section 23 05 02 Pipework Testing supplemented as specified herein.

3.8 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing in approved laboratory for analysis and provide certification that all samples are clean copper. Let system flush for additional 2 h, then draw off another sample for testing.
- .2 Obtain written approval from Departmental Representative

3.9 DISINFECTION

- .1 Supply materials and test kit to carry out disinfection as follows:
 - .1 Fill piping system and tanks with chlorine/water solution with a strength of at least 50 mg/L. Ensure pipe is full and no air pockets remain.
 - .2 Leave solution in piping system for 24 hours, while maintaining a pressure of 175 kPa.
 - .3 After 24 hours sample and test the chlorine solution. If the chlorine residual is at least 25mg/L, the disinfection will be considered successful. Flush chlorine solution from the system. Protect against contamination of the disinfected system.
- .2 If the chlorine residual is less than 25 mg/L, flush the system, clean any deleterious material, reflush and disinfect again. Repeat until satisfactory.
- .3 If, in the opinion of the Departmental Representative, any component of the potable water system becomes contaminated after disinfection, it shall be flushed and disinfected again at no additional cost.
- .4 Obtain water sample off longest run. Test in approved laboratory for bacteriological analysis and provide certification that all samples are suitable for human consumption prior to interim-occupancy inspection.
- .5 Upon completion, provide laboratory test reports on water quality for approval by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .4 ANSI B16.24, Bronze Pipe Flanges and Fittings, Class 150 and 300.
- .5 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- .6 ASTM B 88M, Specification for Seamless Copper Water Tube (Metric).
- .7 MSS SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittals.
- .2 Submit data for following: valves.

1.3 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 01 33 00 - Submittals.

Part 2 Products

2.1 PIPING

- .1 Domestic hot and cold systems:
 - .1 Copper tube, hard drawn, type K (within building) or L (below building): to ASTM B 88M.

2.2 FITTINGS

- .1 Domestic hot and cold systems:
 - .1 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
 - .2 Cast copper, solder type: to ANSI B16.18.
 - .3 Wrought copper and copper alloy, solder type: to ANSI B16.22.

2.3 JOINTS

- .1 General:
 - .1 Lead free solder.
 - .2 Teflon tape for threaded joints.

2.4 CHECK VALVES (HORIZONTAL)

- .1 To MSS SP-80, Class 125, 860 kPa, bronze body, bronze swing

disc, screw in cap, regrindable seat, soldered.

- .2 To MSS SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat, screwed.

2.5 CHECK VALVES (VERTICAL)

- .1 Class 125, 860 kPa, bronze body, bronze disc, lift type, vertical way, screwed ends.

2.6 BALL VALVES

- .1 Class 600, bronze body, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.
- .2 Class 600, bronze body, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, with soldered joint end.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada - 2010.
- .2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.
- .3 Assemble all piping using fittings manufactured to ANSI standards.
- .4 Install tubing close to building structure to conserve headroom and space. Group exposed piping and run parallel to walls.
- .5 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
- .6 Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.
- .7 Copper fixture supply pipes shall be secured to proper backing in the walls with wing back 90 degree elbows screwed to back with #8 x 50 mm long wood screws.
- .8 Install flanges or unions and isolation valves to permit removal of equipment without disturbing piping systems, as required by sizing standard.
- .9 Install pipette bushings where piping passes through steel studs.
- .10 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

3.2 VALVES

- .1 Isolate equipment, fixtures and branches with ball isolation valves.

3.3 PRESSURE TESTS

- .1 Conform to requirements of Section 23 05 01 - Common Work Results

for Mechanical.

- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

3.5 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

3.6 START-UP

- .1 Timing: Start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring DHW storage tank up to design temperature slowly.
 - .4 Monitor piping systems for freedom of movement, pipe expansion as designed.
 - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

3.7 OPERATION REQUIREMENTS

- .1 Operational requirements in accordance with Section 01 47 19 - Sustainable Requirements: Operation, include:
 - .1 Cleaning materials and schedules.
 - .2 Repair and maintenance materials and instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM B 32-00e1, Specification for Solder Metal.
- .2 ASTM B 306-02, Specification for Copper Drainage Tube (DWV).
- .3 ASTM C 564-97, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .4 CSA B67-1972 (R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
- .5 CSA B70-02, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .6 CSA B125-01, Plumbing Fittings.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary and vent Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.
 - .2 Wrought copper: to CAN/CSA-B125.
 - .2 Solder: tin-lead, 50:50, type 50A , to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Above ground sanitary and vent: to CAN/CSA-B70.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene compression gaskets with stainless steel clamps.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada - 2010.
- .2 Install piping parallel and close to walls to conserve headroom and space, and grade as indicated as per NPC.

3.2 GENERAL

- .1 Use of cast iron/copper DWV piping is acceptable throughout the building and exterior to the building unless noted.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM D 2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Pipe and Fittings.
- .2 CSA B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
- .3 CSA B181.12, Recommended Practice for the Installation of PVC Drain, Waste and Vent Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

- .1 Certified PVC to CSA B181.2 listed for use in noncombustible construction, ULC listed to CAN4-S102.2, flame spread rating maximum 25.

2.2 JOINTS

- .1 Solvent weld for PVC: to ASTM D 2564-02.
- .2 Use two part system with primer and solvent cement.
- .3 Primers and solvent cements to be low VOC to content limits of SCAQMD Rule #1168
- .4 Primer: low VOC, NCF approved and to ASTM F-656. 4.1
- .5 Cement: low VOC, NCF and UPC approved and to ASTM D-2564.

Part 3 Execution

3.1 GENERAL

- .1 Listed PVC DWV piping and fittings acceptable throughout building with the following exceptions:
 - .1 DWV vent through roof for min 1500 mm to roof penetration and through roof.
 - .2 All electric and hydronic heat traced piping.
 - .3 All exterior building DWV piping.
 - .4 Utilidors.

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code and to following standards.
- .2 Install PVC drain, waste and vent pipe and pipe fittings in accordance with CSA B181.12 and to the manufacturers listings.
- .3 Install piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

- .4 Provide specified fire stopping systems for piping thru fire rated walls and floors where required.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA B137.3 - PVC pipe for pressure applications
- .2 American Society for Testing and Materials (ASTM)
 - .1 D1785 Standard specification for poly Vinyl Chloride (PVC) plastic pipe, schedules 40, 80 and 120.
- .3 ASTM D2467, PVC plastic pipe fittings, schedule 80
- .4 Section 23 05 00 - Common Works Results for HVAC

Part 2 Products

2.1 PIPING and FITTINGS

- .1 Application: water treatment, chlorination
- .2 Pipe: Schedule 80 plastic pipe to ASTM F441.
- .3 Fittings: schedule 80 to ASTM D2467
- .4 Joints:
 - .1 Solvent cement - environmentally friendly, low odour, low VOC.
 - .2 Flanged
 - .3 Grooved

2.2 VALVES

- .1 Butterfly valves:
 - .1 Valve and Body: PVC resin valve body and disc to ASTM D-1784
 - .2 Seats: EPDM
 - .3 Seals: EPDM O-ring
 - .4 Valve shaft: 420 stainless steel
 - .5 Operators:
 - .1 Manual hand lever with spring lock on all valves.
- .2 Ball Valves:
 - .1 Valve, body, stem, ball and unions: PVC resin valve body and disc to ASTM D-1784
 - .2 Seats: EPDM
 - .3 Seals: EPDM O-ring
 - .4 Design: full port with quarter turn
 - .5 Rating: 150 psi @ 73 deg F

- .6 Operator: T handle equipped with removable spanner device.

Part 3 Execution

3.1 INSTALLATION

- .1 Install pipe and pipe fittings in accordance with CSA B181.12 and to the manufacturers listings and as per process drawings.
- .2 Install piping parallel and close to walls and ceilings and as required to conserve headroom and space.
- .3 Join pipes to requirements of manufacturer's latest instructions.
- .4 Install pipe hangers as per manufacturer's instructions.
- .5 Provide specified fire stopping systems for piping thru fire rated walls and floors where required.

3.2 TESTING

- .1 Hydraulically test pipe to 1.3 times normal operating pressure. Maintain pressure for 4 hours.

3.3 CLEANING, FLUSH and DISINFECTION

- .1 Thoroughly disinfect by chlorination as per AWWA C653 standard and requirements of authority having jurisdiction.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 Submittal Procedures.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/AWWA A100 97, Water Wells.
 - .2 National electrical Manufacturer's Association (NEMA)
 - .3 Canadian Groundwater Association Well Construction Guidelines
 - .4 ASTM A53/A53M-01, Standard specification for pipe, Steel, Black and hot dipped, zinc coated, welded and seamless.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Indicate:
 - .1 Connections, piping, fittings, pump performance, weights, power cable data.
 - .2 Dimensions, construction details and recommended installation.
 - .3 Maintenance instructions.

1.4 EXISTING WATER WELLS

- .1 There are two existing water wells. The first well was drilled and developed as a GUDI well and is referenced as the "old well" or WW-0. The second well was drilled in the fall of 2014 and is the "new well" or WW-1.
- .2 WW-0 is to be disconnected from the site services and is to remain for fire water supply only.
- .3 Water Well WW-1
 - .1 UTM NAD83 wellhead coordinates: Zone 08, N 6591534, E 422439
 - .2 WW-1 was drilled and completed by first advancing a 305 millimeters (mm) (12 inch)diameter steel surface casing to approximately 5 m (11 ft) below ground surface (bgs) in the unconsolidated surficial soils and grouted in place, then a 254 mm (10 inch) diameter steel casing advanced through the surface casing into bedrock to approximately 15 m (50 ft) bgs. A 152 mm (6 inch) steel casing was installed through the 10-inch casing bedrock to approximately 105 m (345 ft) bgs and grouted in place. The 6 inch drill bit was advanced to the final depth of 146 m (480 ft) bgs. WW-1 is artesian, has an available drawdown calculated to be approximately 93 m (305 ft) and

sustainable yield estimated to be 185 L/min (49 USgpm) with recommended pumping rates not significantly higher than 76 L/min (20 USgpm).

- .3 The 152mm steel well casing for WW-1 sticks up above grade and is currently flowing to the river.

1.5 SCOPE OF WORK

- .1 WW-1
 - .1 Provide new drain connection tapped into side of 150mm dia casing and drain water level down.
 - .2 Cut casing per drawings.
 - .3 Install new well pump.
 - .4 Provide new heated well enclosure.
 - .5 Insulate and provide heat trace as indicated on drawings.
- .2 WW-0
 - .1 Remove existing surface well pumps and turn over to Departmental Representative.
 - .2 Remove existing drop pipe and all connections to the pumps.
 - .3 Provide new drop pipe with flange connections at surface and extend to exterior of building to allow for fire protection trucks to connect and draw fire water.
 - .4 Install new sign at connection indicating "FIRE WATER, NOT POTABLE".
 - .5 Retain well building and heating.

1.6 QUALIFICATIONS

- .1 Well service Contractor to be skilled and experienced in artesian well service.

Part 2 Products

2.1 SUBMERSIBLE PUMP P1.1

- .1 Multi stage vertical turbine pump
- .2 Capacity: as per drawing schedule
- .3 Construction:
 - .1 Motor: CSA certified, NEMA 31, motor assembly made of corrosion resistant stainless steel, hermetically sealed stator windings, water lubricated, carbon/ceramic thrust bearings.
 - .2 Impeller: stainless steel

- .3 Power: see drawing schedule.
- .4 Power cable:
 - .1 Minimum 135 metres long. Splice in well casing is not acceptable.
 - .2 Cable to be suitable for 208VAC, submersible, flexible flat wire sized to carry electrical load.

2.2 RISER PIPE

- .1 Standard wall galvanized steel pipe.
- .2 Joints: threaded coupling.
- .3 Maximum length per pipe section = 4 metres
- .4 Total length of pump column plus pump & motor = 130 metres
- .5 Provide one 300mm long threaded column complete with welded lifting eye/hook on opposite end for use during installation of column and pump. Turn over to Departmental Representative at completion of project.

Part 3 Execution

3.1 SUBMERSIBLE PUMP

- .1 Connect pump discharge pipe with anti torque arrestor to riser pipe.
- .2 Secure power cord to pump discharge pipe with double wrapped electrical tape at 900mm centres.
- .3 Secure heat trace to column. Refer to div 26.
- .4 Use electric winch and retaining clamps as required to lower and/or raise pump and column.

3.2 DISINFECTION

- .1 Disinfect pump and riser pipe and electrical appertenances in accordance with ANSI/AWWA C654.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .2 CSA B51-03, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 MAINTENANCE AND ENGINEERING DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 ELECTRIC DHW HEATER STORAGE TANK DHWH-1

- .1 To CSA C22.2 No. 110-M981 minimum recovery rate per hour 68l/h based on 55 deg C rise.
 - .1 Tank: glass lined steel, replaceable magnesium anode, 50 mm mineral wool or fibre insulation, enamelled steel jacket, 19 dia. hose threaded drain valve.
 - .2 Trim: ASME rated temperature/pressure valve minimum 860 kPa, operating controller and separate high limit control.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in water treatment room. Secure with wall brackets.
- .2 Install drip pan below DHWH, pipe to floor drain.
- .3 Install level and secure in accordance with manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
- .3 ANSI Z358.1-2009, Emergency Eyewash and Shower Equipment.

1.2 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittals.
- .2 Indicate dimensions, construction details and materials for the following: floor drains, cleanouts, hose bibbs, traps, trap seal primer, check valves

Part 2 Products

2.1 HOSE BIBBS (TYPE 1)

- .1 19 dia. brass construction complete with integral vacuum breaker, hose thread spout, replaceable composition disc.

2.2 STRAINERS

- .1 1035 kPa, Y type with 20 mesh, stainless steel removable screen, bronze body screwed cap, threaded ends.

2.3 COMBINATION DRENCH SHOWER AND EYEWASH STATION

- .1 General: Packaged free standing, combination drench shower, eyewash station.
- .2 Bowl: impact resistant plastic with dust cover.
- .3 Sprayhead assembly: 78mm dia impact resistant plastic spray head with integral flow control sized at 1.64 l/s at 207 kPa.
- .4 Eye wash: dual heads with internal flow control and filtering. Soft flow spray heads, minimum flow 0.30 l/s at 207kPa.
- .5 Eyewash valve: 13dia IPS chrome plated brass stay open ball valve activates on 304 stainless steel push flag handle.
- .6 Shower valve: 25mm dia chrome plated brass self closing shower valve actived by 316 stainless steel pull rod.
- .7 Mounting: Sched 40 galvanized steel piping, with orange polyethylene cover on vertical piping. Cast aluminum floor flange.
- .8 Waste: 32mm dia tee.
- .9 Compliance: ANSI Z358.1-2009.

2.4 MIXING VALVE

- .1 Emergency fixture thermostatic mixing valve to ASSE 1071 and CSA B125.3, liquid filled thermal motor with piston driven positive shut off of hot supply if cold water supply lost to prevent scalding, valve to allow cold flow in event of loss or interruption of the hot water supply or thermostat failure, preset to 29degC, rough brass, key operated checkstops, liquid filled bi-metallic thermometer, FPT connections, built in cold water bypass, suitable for face/eyewash and shower application.
- .2 Mounting: Surface mounted exposed.
- .3 Piping: prepiped w/ inlet and outlet shutoff. Compliance: ANSI Z358.1.
- .4 Capacity:
 - .1 Min Flow: 87L/min
 - .2 Rated at: 116 L/min at 23 kPa pressure drop.
 - .3 Flow rate based on supply temperature to fixture = 29 deg C, DCW temp = 4 deg C, DHW = 60 deg C

2.5 FLOOR DRAIN

- .1 Type 1: general duty; cast iron body round, adjustable head, sediment basket nickel bronze strainer, integral seepage pan suitable for installation in concrete deck, and clamping collar.

2.6 CLEANOUTS

- .1 Provide caulked or threaded type extended to finished floor or wall surface. Ensure ample clearance at cleanout for rodding of drainage system.
- .2 Floor cleanout access covers in unfinished areas shall be round with nickel bronze scoriated frames and plates. Provide round access covers in finished areas with depressed centre section to accommodate floor finish. Wall cleanouts to have chrome plated caps.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

- .1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Stack base cleanouts to line size up to maximum 100 dia.

3.3 HOSE BIBBS

- .1 Install interior hose bibb at 1200 AFF where indicated on drawings.
- .2 Install exterior at 900mm AFG where indicated on drawings.

3.4 STRAINERS

- .1 Install with sufficient room to remove basket.

3.5 PLUMBING VENT

- .1 Coordinate with roof flashings and install as per manufacturers recommendations.

3.6 DRENCH SHOWER EYEWASH STATION

- .1 Install as per manufacturer's recommendations
- .2 Install mixing valve on wall above eyewash station. Adjust mixing valve to provide temperature as per manufacturer's instructions.
- .3 Adjust supply temperature to ES-1 to 30 deg C

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45 Series-, Plumbing Fixtures.
 - .2 CAN/CSA-B125.3-, Plumbing Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Product

2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Stainless steel counter-top sinks.
 - .1 SK-1: single compartment, ledge at back and one end.

- .1 From 1.0 mm thick type 302 stainless steel, self-rimming, undercoated, clamps.
- .2 Trim: chrome plated brass, laboratory type with gooseneck swing spout, aerator, indexed hooded lever handles, accessories to limit maximum flow rate to 8.35 litres/minute at 413 kPa.
- .3 Waste fitting: integral stainless steel basket strainer/ stopper, tailpiece.
- .5 Fixture piping:
 - .1 Hot and cold water supplies to each fixture:
 - .1 Chrome plated rigid supply pipes each with handwheel stop, reducers, escutcheon.
 - .2 Waste:
 - .1 Brass P trap with clean out on each fixture not having integral trap.
 - .2 Chrome plated in all exposed places.

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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 51 00 -Temporary Utilities.

1.2 EXISTING PRODUCTS

- .1 Use of new permanent heating systems for supplying temporary heat is not permitted.
- .2 Construction use of air systems, air handling units, heat recovery ventilators, fans or any associated equipment and systems for ventilation, heating, de-humidification, humidification, dust control or any other use is strictly prohibited during the course of construction.

Part 2 NOT USED

Part 3 NOT USED

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section covers items common to all sections of mechanical including division 22, and 23.

1.2 EQUIPMENT LIST

- .1 Complete list of equipment and materials to be used on this project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

1.3 EQUIPMENT INSTALLATION

- .1 Unions or flanges: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
- .3 Equipment drains: pipe to floor drains where noted on drawings or specified.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.4 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation by other divisions where required.

1.5 TRIAL USAGE

- .1 Departmental Representative may use equipment and systems for usage prior to acceptance. Supply labour, material, and instruments required for testing.

1.6 PROTECTING OF NEW AND EXISTING OPENINGS DURING CONSTRUCTION

- .1 Protect all new and existing equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.7 ELECTRICAL

- .1 Electrical work to conform to Division 26 Canadian Electrical Code, Territorial/Local Authorities and include the following:
 - .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated herein.
 - .2 Control wiring and conduit is specified in Division 26.

1.8 MOTORS

- .1 Provide motors to CSA Standards for mechanical equipment as

specified.

- .1 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .2 Motor phase, cycle and voltage are specified within this Division. Coordinate with Division 26 regarding specified or substitute motors. Refer discrepancies to Departmental Representative for review.
- .3 Motors over 0.75 kW to be high efficiency, high power factor. Motors to be TEFC, ODP, et cetera as specified. Where not indicated, motors to be open drip proof (ODP) for pumps and Open for fans.

1.9 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: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .5 Motor slide rail adjustment plates to allow for centre line adjustment.

1.10 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.

1.11 EQUIPMENT SUPPORTS

- .1 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of Section 055000 - Metal Fabrications.
- .2 Mount all base mounted equipment and tanks on chamfered edge housekeeping pads, minimum of 100 mm high and 150 mm larger than equipment dimensions all around. Concrete specified in Section 033000 - Cast-in-Place Concrete to be reinforced with 152 x 152 8/8 MW welded wire mesh unless otherwise noted.
- .3 All equipment supports of structural steel to be mounted on either a concrete housekeeping pad and secured to pad with approved insert type anchors or on a structural steel base with a welded connection.

1.12 SLEEVES

- .1 Pipe sleeves: at points where pipes pass through fire rated assemblies and as indicated.
- .2 All sleeves to be minimum 16 gauge.
- .3 Sleeves with annular fin continuously welded at midpoint:
 - .1 Where sleeve extends above finished floor.
 - .2 Through foundation walls.
- .4 Sizes: minimum 6 mm clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CAN/CGSB-1.181-99.
- .6 Fill voids around pipes:
 - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.
 - .2 Where sleeves pass through walls, provide space for firestopping. Where pipes/ducts pass through fire rated walls, maintain fire rating integrity.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.

- .4 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CAN/CGSB-1.181-99.

1.13 TESTS

- .1 Give 14 days written notice of date for tests.
- .2 Insulate or conceal work only after testing and approval by Departmental Representative.
- .3 Conduct tests in presence of Departmental Representative and authority having jurisdiction.
- .4 Bear costs including retesting and making good.
- .5 Piping:
 - .1 General: maintain test pressure without loss for 12 h unless otherwise specified.
 - .2 Hydraulically test new and existing hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
 - .3 Test fuel oil system hydrostatically to minimum 345kPa and highest point and to the requirements of authorities having jurisdiction.
 - .4 Test drainage, waste and vent piping to National Building Code, the National Plumbing Code and authorities having jurisdiction. Provide for ball test where directed by Departmental Representative. Provide for hydraulic test for all drainage piping with minimum 1.5 m of hydrostatic head for 15 minutes.
 - .5 Test domestic hot and cold water piping at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
 - .6 Test raw water and treated water piping at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
- .6 Equipment: test as specified in relevant sections.
- .7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.14 PAINTING

- .1 As per Section 09 91 23 - Interior Painting.
- .2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .3 Prime and touch up marred finished paintwork to match original.
- .4 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.
- .5 All painting is to be performed by a qualified journeyman painter to the requirements of Section 09 91 23 .

1.15 SPARE PARTS

- .1 Furnish spare parts for non-treatment systems as follows and in accordance with Section 01 77 00 - Contract Closeout and as follows:
 - .1 General:
 - .1 One casing joint gasket for each size pump.
 - .2 One set of belts for each piece of machinery.
 - .3 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
 - .2 Instrumentation & control:
 - .1 Three (3) spare paddles for flow control devices.
 - .2 Two (2) spare control relays for each type supplied.
 - .3 Two (2) spare fuses for each type supplied.
 - .4 Two (2) spare indicator lamps for each type supplied.

1.16 SPECIAL TOOLS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and as indicated in equipment specifications and in accordance with Section 01 77 00 - Contract Closeout.

1.17 DIELECTRIC COUPLINGS

- .1 General:
 - .1 To be compatible with and to suit pressure rating of piping system.
 - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes 50 dia. and under: isolating unions, flanges or cast brass adapters.
- .3 Pipes 63 dia. and over: isolating flanges.

1.18 DRAIN VALVES

- .1 Locate at low points and at section isolating valves unless otherwise specified.
- .2 Minimum 19 dia. class 600 brass body/ball, brass gland, PTFE teflon seat, steel lever handle, male hose end c/w cap and chain.

1.19 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Provide demonstration and maintenance instruction as indicated in section 01 79 00 - Demonstration and Training and as follows.

- .2 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.
- .3 Where specified elsewhere in mechanical division, manufacturers to provide demonstrations and instructions.
- .4 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
- .5 Operating personnel shall be contacted at the beginning of the project and encouraged to come on site at least once a week for the duration of the project. During these periods, they shall be given full explanation of the various systems as the project progresses.
- .6 Two weeks prior to interim inspection, operating personnel shall be given instruction for a period of two weeks with minimum of two hours per day. Instruction to be provided during regular work hours. Provide a video tape recording of all training seminars for future use by Departmental Representative. Appropriately label each video tape, indicating the date the video was made and the scope of the building systems covered within the video.
- .7 Maintain log of all site visits. Maintenance personnel to login/out and be witnessed by Contractor. Provide log as requested.

1.20 OPERATION AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 77 00 - Contract Closeout.
- .2 Operation data to include:
 - .1 New and revised control schematics for each system including environmental and process controls.
 - .2 Description of operation of each new and renovated control system at various loads together with reset schedules and seasonal variances, and complete points list.
 - .3 New valve schedule and flow diagram.
 - .4 Descriptions of actions to be taken in event of equipment failure.
 - .5 Colour coding chart.
 - .6 Existing, applicable, Operation & Maintenance Material.
- .3 Maintenance data shall include:
 - .1 Equipment manufacturer's servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
- .4 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 230593 - Testing, Adjusting and Balancing.
- .5 Equipment data to include:
 - .1 Complete reviewed shop drawings of all mechanical equipment including details of suppliers.
 - .1 Approvals:
 - .2 Submit 1 copy of complete draft Operation and Maintenance data to Departmental Representative for approval. Submission of individual data will not be accepted.
 - .3 Make changes or provide additional data as required and re-submit as directed by Departmental Representative.
 - .4 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.21 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittals.
- .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 Year of manufacture and manufacturers recommended list of spare parts.
 - .3 Acoustical sound power data, where applicable.
 - .4 Points of operation on performance curves.
 - .5 Manufacturer to certify as to current model production.
 - .6 Certification of compliance to applicable codes.

1.22 CLEANING

- .1 Clean all new, existing, and renovated mechanical systems affected during construction in accordance with Section 01 77 00 - Contract

Closeout.

- .2 Clean interior and exterior of all new and existing systems including strainers. Vacuum interior of air handling units.
- .3 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

1.23 RECORD DRAWINGS

- .1 Provide a complete set of Record Drawings at the completion of each phase of construction.
- .2 Site records as per Section 01 33 00:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon 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 Use different colour waterproof ink for each service.
 - .3 Make available for reference purposes and inspection at all times.
 - .4 Transfer valve schedule number to site records identifying all tagged valves on drawings.
 - .5 Transfer total corrected HW media volume to site records.
- .3 Record drawings as per Section 01 33 00:
 - .1 Prior to start of Testing, Adjusting and Balancing (TAB), provide site record drawings to allow finalized production of record drawings. Submit to Departmental Representative.
 - .2 As built information to be transferred to RECORD DRAWINGS utilizing AutoCADD 2004. Drawing standards to be as per current standards utilized for completion of original drawings.
 - .3 Provide full size drawings for review by Departmental Representative. Provide final full size copies including all necessary changes.
 - .4 Provide reduced 11x17 copies of record drawings for inclusion in final O & M Manual and TAB report.
 - .5 Provide to Departmental Representative one software disc copy on CD ROM of the final Record Drawings.
 - .6 Record drawings to be complete with all control drawings and detail sheets presently located in specification. Insert schematics and details on new drawing sheets, number as required.

1.24 BUILDING AND WATER SYSTEM START UP

- .1 Conduct performance tests as per section 01 79 00 - Demonstration and Training and as supplemented below. Demonstrate that equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, adjustments and replacements required as tests may indicate prior to operating tests.
- .2 Make operating tests for minimum of five days for proper settings of control under actual or simulated peak load conditions.
- .3 Conduct final operating tests in the presence of the Departmental Representative. Vary loads to illustrate start-up and shutdown, sequence and simulate emergency conditions for safety shutdowns, with automatic and manual reset. Repair and test defects until satisfactory. Make final adjustments to suit exact building conditions.
- .4 Provide services of one job mechanic, ladders, tools and associated equipment required to assist the Departmental Representative in final tests.
- .5 Lubricate bearings, adjust and/or replace and set direct and V belt drives for proper alignment and tension.
- .6 Calibrate and adjust thermostats, thermometers, gauges, linkage and dampers. Control valves shall operate freely.
- .7 Operate and test motors and speed switches for correct wiring and sequences. Check overload heaters in motor starters.
- .8 Replace and clean filters. Clean fan wheels and coils.
- .9 Remove and clean strainers. Fill systems and purge air.
- .10 Fasten loose and rattling pieces of equipment. Equipment shall operate quietly and develop specified capacities.
- .11 Provide personnel to assist TAB for full duration of TAB site works.
- .12 Operating tests to occur in conjunction with Controls commissioning. Coordinate with Departmental Representative.

1.25 SITE INSPECTIONS

- .1 Provide for mechanical job foreman and representatives of all applicable mechanical sub trades to be on site and available during periodic site inspections by Departmental Representative.

1.26 MECHANICAL CONTRACT BREAKDOWN

- .1 Provide the following contract breakdown in all progress billing submittals:
 - .1 Plumbing and Drainage
 - .1 Material
 - .2 Finish Labour

- .2 Water Well
 - .1 Material
 - .2 Finish Labour
- .3 Water Service and Distribution
 - .1 Material
 - .2 Finish Labour
- .4 Building Heating & Ventilation System
 - .1 Materials
 - .2 Finish Labour
- .5 Controls
 - .1 Materials
 - .2 Finish Labour
- .6 Fire Protection
- .7 Operation and Maintenance Manuals

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 RELATED SECTIONS

- .1 Section 01 74 11 - Cleaning.
- .2 Section 07 84 00 - Fire Stopping.
- .3 Section 23 05 03 - Mechanical Start-up.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)

Part 2 NOT USED

2.1 NOT USED

- .1 NOT USED

Part 3 Execution

3.1 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.
- .4 Use flexible pipe connection for generator exhaust piping as required by the generator manufacturer.

3.2 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.

3.3 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 where indicated. Discharge to be visible

3.4 AIR VENTS

- .1 Install manual air vents at high points in piping systems except provide automatic air vents in mechanical room or where indicated.
- .2 Install isolating valve at each automatic air valve.

3.5 DIELECTRIC COUPLINGS

- .1 General:
 - .1 To be compatible with and to suit pressure rating of piping system.
 - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes NPS 2 and under: isolating unions, flanges or cast brass adapters.
- .3 Pipes NPS 2 1/2. and over: isolating flanges.

3.6 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape unless otherwise noted.
- .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 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
- .6 Install exposed piping, equipment, rectangular clean outs and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space. Run exposed piping parallel to walls.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes, remove scale and other foreign material before assembly
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as required and where indicated.

3.7 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: min 16ga formed steel or galvanized sched 10 pipe.
- .3 Construction: provide sleeves with annular fin continuously welded at

midpoint or offset.

- .1 Where sleeve extends above finished floor. Secure fin in floor.
- .2 Where sleeve set in wall. Sleeve offset to one side of wall or adjust annular fin to center sleeve thru wall. Secure fin to wall.
- .4 Sizes: 6 mm minimum, 13mm maximum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CAN/CGSB-1.181-99.

3.8 ESCUTCHEONS

- .1 On pipes passing through walls, partitions, floors and ceilings in finished areas.
- .2 Simulated chrome finish plastic one piece or split type without set screws.
- .3 Outside diameter to cover opening or sleeve.
- .4 Inside diameter to fit around finished pipe.

3.9 PREPARATION FOR FIRESTOPPING

- .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Fire Stopping.
- .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 firestopping material or installation.
- .4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 11 - Cleaning.
- .2 Section 07 84 00 - Fire stopping.
- .3 Section 23 25 00 - HVAC Water Treatment Systems.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB).
- .2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA).
- .3 CAN/CSA-B139, Installation Code for Oil Burning Equipment.

1.3 GENERAL

- .1 This section covers testing of piping systems and duct systems and startup of systems common to all sections of Division 23.

1.4 DEFINITIONS

- .1 Initial Tests:
 - .1 Tests performed prior to final tests to verify general systems integrity. Tests are performed by the Contractor at their discretion.
- .2 Final Tests:
 - .1 Mandatory tests performed to confirm system integrity. Final tests to be witnessed by Departmental Representative and Authority having jurisdiction except where specifically noted.

Part 2 NOT USED

2.1 NOT USED

- .1 NOT USED

Part 3 Execution

3.1 NOTIFICATION

- .1 Give 7 days written notice of date and test type for Final Tests.
- .2 Provide written notice as per the requirements of Section 01 33 00-Submittal Procedures.
- .3 Written notice to include request for confirmation of witnessing of Final Tests by Departmental Representative and Authority having jurisdiction.

3.2 COSTS

- .1 Bear all costs for testing, making good and retesting.
- .2 Final Tests are not complete until accepted by Departmental Representative and Authority having jurisdiction. No additional payment shall be made for retesting to meet requirement of these parties for acceptance of tests.

3.3 WITNESSES

- .1 Witnessing of tests by the Departmental Representative and Authority having jurisdiction may be provided by designated Alternates at the discretion of the Departmental Representative or Authority having jurisdiction.

3.4 TESTING (GENERAL)

- .1 Insulate or conceal work only after testing and approval by Departmental Representative.
- .2 Conduct tests from commencement to finish in presence of Departmental Representative and Authority having jurisdiction or designated Alternate witnesses except where Acceptance of test is waived as per Part 3.3.
- .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 or test medium.
- .5 Check systems during application of test pressure including visual check of leakage of water test medium, soap test for air or nitrogen test medium and halide torch for refrigerant medium.
- .6 When using water as test medium for system not using water or steam, evacuate and dehydrate piping and certify that lines are dry. Use agency specializing in this work.

3.5 PIPEWORK TESTS

- .1 General:
 - .1 Provide the following tests for complete assembled systems.
 - .2 Section systems as necessary for all initial tests and test complete system for final tests.
 - .3 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubble test for air.
 - .4 During heating and cooling piping system tests, check linear expansion at elbows, U bends, expansion joints and offsets for proper clearance.
 - .5 When using water as test medium for system not using water, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.

- .6 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubbler test for air or nitrogen test medium and halide torch for refrigerant medium.
- .7 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.
- .2 DWV Piping:
 - .1 Initial test: Provide for sectional ball tests to NPC where directed by Departmental Representative or Authorities having jurisdiction.
 - .2 Final tests: Hydraulic test for all drainage piping with minimum 1.5 m of hydrostatic head for 15 minutes.
- .3 Domestic water(Rigid Piping):
 - .1 Initial test: Pneumatic. Acceptable for boarding where heating not available. Test pressure not less than 413kPa. Minimum 30 minutes.
 - .2 Final test: Hydraulic. Minimum 860kPa. Minimum 12hrs.
- .4 Fuel Oil:
 - .1 Test system in accordance with CAN/CSA-B139 and CAN/CSA-B139 and authorities having jurisdiction.
 - .2 Test all suction and supply piping under 15in Hg vacuum and maintain vacuum for minimum 5min without loss of vacuum with no additional vacuum applied during test period.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 22 30 05 - Domestic Water Heaters.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 This section covers testing of piping systems and duct systems and startup of systems common to all sections of Divisions 22, and 23.

1.3 START-UP OF MECHANICAL SYSTEMS (GENERAL)

- .1 Conduct operating startup to confirm that equipment and systems meet specified requirements after mechanical installations are completed and pressure tested and all systems operational. Conduct startup as soon as conditions permit. Make changes, repairs, adjustments and replacements required as tests may indicate prior to final operating tests.
- .2 Startup only after completion of all pressure testing and substantially complete installation of systems.
- .3 During start up advise Departmental Representative in writing of any system deficiencies that are evident and request direction.
- .4 Make start up for a minimum of seven days under maximum available operating load conditions.
- .5 Where seasonal lockout of equipment is specified override seasonal lockout and operate equipment for full seven days of startup. Where seasonal conditions do not allow for this, provide for deferred 7-day startup of affected system.
- .6 Where lead/lag or main/standby staging specified override normal staging to change lead equipment on 24 hour rotation for full seven days of startup.
- .7 During startup provide the following operations and maintenance procedures:
 - .1 Lubricate bearings, adjust and/or replace and set direct and V belt drives for proper alignment and tension.
 - .2 Calibrate and adjust thermostats, thermometers, gauges, linkage and dampers. Control valves shall operate freely.
 - .3 Operate and test motors and speed switches for correct wiring and sequences. Check overload heaters in motor starters.
 - .4 Air systems:
 - .1 Startup fans, coil circulators, exhaust air systems and interlocked cooling systems.
 - .2 Balance systems in conformance with Section 23 05 93 -

- Testing, Adjusting and Balancing.
- .3 Complete all fire dampers tests in conformance with Section 23 05 93 - Testing, Adjusting and Balancing.
 - .4 Operate all air systems at normal operating set points at 100% for building flush out for one week. The one week operation can occur during the one week startup. See Section 23 05 93 - Testing, Adjusting and Balancing for additional requirements.
 - .5 Replace and clean filters. Clean fan wheels and coils.
 - .5 Domestic water systems:
 - .1 Provide startup of DW systems and equipment specified in Division 22.
 - .2 Startup all pumps, hot water heaters, and ancillary equipment.
 - .3 Balance systems in conformance with Section 23 05 95 - Testing, Adjusting and Balancing.
 - .4 Complete all flushing and cleaning and disinfection as specified.
 - .5 Aerator screens and strainers: clean out.
 - .6 Drainage systems:
 - .1 Provide startup of DW systems and equipment specified in Division 22.
 - .2 Flush each valve, operate each faucet to ensure drainage and trap anti-siphoning venting is effective.
 - .3 Open each cleaout cover and reseal. Ensure all CO are fully accessible.

1.4 **SYSTEM TESTS**

- .1 Conduct specified system tests in presence of Departmental Representative to confirm that equipment and systems meet specified requirements. Conduct system tests during inspection and only after system startup completed.
- .2 Where directed by the Departmental Representative make changes, repairs, adjustments and replacements within the scope of these documents as required to allow completion of the system tests.
- .3 Provide all tools and equipment necessary to complete specified tests. Patch and make good any damage created during tests at no additional cost.
- .4 Provide tradespersons knowledgeable in operation of all systems to be tested and demonstrated as required to complete specified tests for the duration of the one day testing period.

- .5 Provide the following tests to be witnessed by the Departmental Representative:
 - .1 Prove random access to cleanouts at the direction of the Departmental Representative.
 - .2 Prove random access through access doors at the direction of the Departmental Representative.
 - .3 Prove random operation of plumbing fixtures including maximum DHW temperature at high limit protected plumbing fixtures and run time on all spring or metered fixtures.
 - .4 Demonstrate operation of all air and water systems & controls
- .6 Prove operation of all safety systems for the following systems or provide test data from Authority having jurisdiction proving successful completion of tests:
 - .1 All Furnaces.
 - .2 All DWH heaters.
 - .3 All fuel systems.

Part 2 NOT USED

Part 3 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-1989, Power Piping, (SI Edition).
 - .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 125-81(1988), Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A 307-94, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A 563-94, Specification for Carbon and Alloy Steel Nuts.

1.2 DESIGN REQUIREMENTS

- .1 Construct well drop pipe connection to prevent excessive stresses from being introduced into pipework.

Part 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Welding: in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in mechanical Divisions.

3.2 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook.

Repair or replace defects as required by codes and as specified.

3.4

REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASME B40.1-2000, Gauges-Pressure, Indicating Dial Type-Elastic Element.
- .2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.
- .2 Indicate on manufacturers catalogue literature the following:
 - .1 Thermometers.
 - .2 Pressure gauges.
 - .3 Wells.
 - .4 Stop cocks.
 - .5 Syphons.
 - .6 Tappings.

1.3 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 01 33 00 - Submittals.

Part 2 Products

2.1 GENERAL

- .1 Thermometers and pressure gauges to operate at mid point of scale or range.

2.2 DIRECT READING THERMOMETERS

- .1 Accuracy +/-1% of dial span throughout entire range to CAN/CGSB-14.4.
- .2 Case: hermetically sealed, 304 stainless steel socket with slip ring.
- .3 Helix: silicone dampening of bimetallic element.
- .4 Socket and stem: 304 stainless steel.
- .5 Stem and length: 100mm-150mm as required for insulation.
- .6 Lens: flat glass.
- .7 Size: 50mm.
- .8 Ranges:
 - .1 HW: -10 to 115 degC

- .2 DW: -5 to 50 deg C
- .3 Boiler breeching: 100 to 550 deg. C.
- .4 O/A duct: -75 to 40 degC.
- .5 E/A duct: -5 to 50 degC.

2.3 REMOTE READING THERMOMETERS

- .1 Remote reading thermometer with stainless steel case, vapour actuated, 2.7m long capillary length.
- .2 Case: 90 mm diameter stainless steel
- .3 Accuracy: 2.5% of full scale
- .4 Range: -40 deg C to +65 deg C.

2.4 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: brass or stainless steel.

2.5 PRESSURE GAUGES

- .1 Dial type to ASME B40.1-2000, self indicating, 2% accuracy and plain case with twist locking ring and recalibration adjustment.
- .2 Bourdon tube: copper alloy tube, tip and socket.
- .3 Dial: Steel, white enamel background, black printed labels.
- .4 Lens: flat glass.
- .5 Movement: brass, bronze bushings, stainless steel pinion and arbor.
- .6 Size: 50mm.
- .7 Snubbers: brass body, as required.
- .8 Ranges:
 - .1 HW:0-413kPa
 - .2 DW:0-1100kPa

2.6 GAUGE VALVES

- .1 Class 600, regular port, threaded, bronze body, plated brass ball, brass gland and PTFE Teflon seat, wing handle, screwed.
- .2 Acceptable material: Kitz, Toyo.

2.7 VACUUM GAUGES

- .1 Dial type to ASME B40.1-2000, self indicating, 2% accuracy and plain case with twist locking ring and recalibration adjustment.
- .2 Dial: Steel, white enamel background, black printed labels.
- .3 Lens: flat glass.
- .4 Movement: brass, bronze bushings, stainless steel pinion and arbor.

- .5 Size: 50mm.
- .6 Ranges:
 - .1 Raw Water: 30" VAC to 210 kPa

Part 3 Execution

3.1 GENERAL

- .1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units on approval of Departmental Representative.
- .2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

- .1 Install in wells on piping. Provide heat conductive material inside well.
- .2 Install in locations as indicated and as required to provide indication of process performance.
- .3 Use extensions where thermometers are installed through insulation.
- .4 Install remote thermometer bulbs in utilidor away from heat source. Locate thermometer in treatment plant as indicated at 1200mm AFF. Provide lamacoid below thermometer indicating service.

3.3 PRESSURE GAUGES

- .1 Install as indicated.
- .2 Install snubbers where required to provide stable indication of system pressure.
- .3 Provide specified ball isolation valves.
- .4 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

- .1 Install engraved lamacoid nameplates as specified in Section 23 05 54 - Mechanical Identification, identifying medium.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 10 - Closeout Submittals.
- .3 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- .1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
- .2 American Society for Testing and Materials (ASTM)
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
- .5 Underwriter's Laboratories of Canada (ULC)

1.3 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 SP58
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

Part 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.
- .3 Support from structural members. Where structural bearing does not exist, provide supplementary structural members.

2.2 UPPER ATTACHMENTS

- .1 Steel joist:
 - .1 Cold piping 50 dia. and under: galvanized steel washer plate with double locking nuts.
- .2 Steel channel, joist or angle (bottom):
 - .1 Malleable iron C clamp to MSS SP-58-1993, type 23, galvanized. ULC listed.
- .3 Steel channel, joist or angle (top):
 - .1 Malleable iron top of beam C clamp to MSS SP-58-1993, type 19, galvanized. ULC listed.
- .4 Concrete:
 - .1 Insert type expanding anchor with 10dia internal threaded rod connection, galvanized steel, CSTB approved. ULC listed.
- .5 Wood joist/beams or eood deck:
 - .1 All piping 50 dia and under and all plastic DWV piping: black malleable iron, galvanized, ceiling flange, rod or pipe threaded.
- .6 Wall Hangers:
 - .1 Carbon steel, plain, medium duty suitable for loads to 675kg, suitable for loading from top or bottom, width as required. Complying with MSS-SP-69(Type 32).
 - .2 Bottom loads: provide carbon steel washer plate, size to suit rod size.

2.3 MIDDLE ATTACHMENT

- .1 Electro-galvanized carbon steel threaded rod material to MSS SP58.

2.4 PIPE ATTACHMENT

- .1 Cold steel, cast iron and PVC/ABS piping, all hot steel piping less than 75dia and all copper piping where insulation shields and inserts provided: plain steel, adjustable clevis to MSS-SP-69 (Type 1), ULC listed, rated to 343degC, extended vertical risers as required for insulation.
- .2 Hot steel piping 100dia and larger: cast iron roll, carbon steel yoke, roll rod and hex nuts, complying to MSS-SP-69(Type 43).
- .3 All cold and hot copper piping where insulation shields and inserts not provided: adjustable clevis to MSS IEEE 58-1978, type 1, Copper plated.
- .4 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563 where indicated.
- .5 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69 where indicated.
- .6 Trapeze hangers: continuous slot formed hot dipped or electro-

galvanized channel, 12Ga minimum with proprietary mounted fasteners and electro galvanized pipe clamps.

2.5 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.7 WALL CLAMPS

- .1 Continuous slot formed hot dipped galvanized channel, 12-14Ga with proprietary mounted fasteners and standard pipe clamps.

2.8 HOUSE-KEEPING PADS

- .1 For base-mounted equipment: Concrete, at least 100 mm high, 150 mm larger all around than equipment unless otherwise required to meet Seismic Restraint Requirements as specified in Section 23 05 49, and with chamfered edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 HANGER SPACING

- .1 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.
 - .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code.
 - .2 Copper piping: up to NPS 1/2: every 1.5 m.
 - .3 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at each joint or to the manufacturers recommendations which ever is more stringent.
 - .4 Within 300 mm of each elbow unless piping otherwise suitably supported to approval of Departmental Representative.
 - .5 Pipework greater than NPS 12: to MSS SP69.
- .2 Hanger Schedule:

Pipe Size	Rod Diameter	Maximum Spacing Steel	Maximum Spacing Copper
(up to) 32 dia	10mm	2.1m	1.8m
38 dia	10mm	2.7m	2.4m
50 dia	10mm	3.0m	2.7m
63 dia	10mm	3.6m	3.0m
75 dia	10mm	3.6m	3.0m
100 dia	16mm	4.2m	3.6m
150 dia	22mm	5.1m	

3.3 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.
- .4 Use of trapeze hangers is acceptable for parallel piping runs.

3.4 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.

3.5 RISER CLAMPS

- .1 Provide riser clamps at all floor penetrations and the base of all piping risers. Exception branch HW & DW piping 25 dia. or smaller.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports: to equalize load and maintain required grade.

3.7 HOUSEKEEPING PAD

- .1 Provide specified housekeeping pads for all base mounted equipment unless otherwise indicated on drawings or on approval of Departmental Representative.
- .2 Housekeeping pads are not required for any exterior basemouted equipment unless indciated on plans.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Seismic restraint systems for statically supported and vibration isolated equipment and systems; including heating and ventilation equipment, fire protection equipment and systems, both vibration isolated and statically supported.

.2 Related Sections:

- .1 Sections 01 33 00 - Submittal Procedures.
- .2 Sections 01 78 00 - Closeout Submittals.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
- .2 SMACNA Seismic Restraint Manual-Guidelines for Mechanical Systems, First Edition, 1991.
- .3 ASHRAE RP-812 Guide to Seismic Restraint, 1999.
- .4 NBCC-2010 National Building Code of Canada.

1.3 DEFINITIONS

- .1 Priority One (P1) Buildings: buildings in which life safety is of paramount concern. This is a Post-Disaster Building.
- .2 SRS: acronym for Seismic Restraint System.

1.4 SYSTEM DESCRIPTION

.1 This section covers provision of SRS for all mechanical distribution systems and equipment including but not necessarily limited to the following:

- .1 DW, and fuel oil piping.
- .2 All ventilation ducts.
- .3 All vibration isolated EF and HRV.
- .4 All vibration isolated pumps.
- .5 All DHWH.
- .6 DW Expansion and Fill tanks.
- .7 Heating Furnace
- .8 Diffusers.

.2 Installation of SRS to be fully compatible with and to not affect performance of:

- .1 Noise and vibration controls specified elsewhere in this project specification.

- .2 Structural, mechanical, and electrical design of project.
- .3 The intent of the SRS systems is both life safety and building operation. It is the intent of the systems to maintain all equipment in operational state after a significant seismic event. During a seismic event, the SRS is to prevent systems and equipment from causing personal injury and from moving from normal position. SRS fully integrated into, and compatible with:
 - .1 Noise and vibration controls specified elsewhere.
 - .2 Structural, mechanical, electrical design of project
- .4 Designed by Professional Engineer specializing in design of SRS and registered in British Columbia.

1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in British Columbia
- .3 Submit design data including:
 - .1 Design calculations (including restraint loads resulting from seismic forces in accordance with National Building Code, detailed work sheets, tables).
 - .2 Separate shop drawings for each SRS and devices for each system, equipment.
 - .3 Identification of location of devices.
 - .4 Schedules of types of SRS equipment and devices.
 - .5 Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
 - .6 Installation procedures and instructions.
 - .7 Design calculations including restraint loads to NBC and Supplement.
 - .8 Detailed work sheets, tables Simplified, Detailed work sheets, tables. Simplified, conservative assumptions may be acceptable.
 - .9 Detailed design of SRS including complete working drawings prepared to same standard of quality and size as Contract Documents, materials lists, design calculations, schematics, specifications.
- .4 Submit additional copy of shop drawings and product data to Structural Engineer for review of connection points to building structure.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Closeout Submittals:

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

Part 2 Products

2.1 SRS MANUFACTURER

.1 SRS from one manufacturer regularly engaged in SRS production.

2.2 GENERAL

.1 SRS to provide gentle and steady cushioning action and avoid high impact loads.

.2 SRS to restrain seismic forces in every direction.

.3 Fasteners and attachment points to resist same load as seismic restraints.

.4 SRS of Piping systems compatible with:

.1 Expansion, anchoring and guiding requirements.

.2 Equipment vibration isolation and equipment SRS.

.5 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.

.6 Attachments to structure:

.1 Use high strength mechanical expansion anchors.

.2 Drilled or power driven anchors not permitted.

.7 Seismic control measures not to interfere with integrity of firestopping.

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS

- .1 Floor-mounted equipment, systems:
 - .1 Anchor equipment to equipment supports.
 - .2 Anchor equipment supports to structure.
 - .3 Use size of bolts scheduled in approved shop drawings.
- .2 Suspended equipment, systems
 - .1 Use one or combination of following methods:
 - .1 Install tight to structure.
 - .2 Cross-brace in every direction.
 - .3 Brace back to structure.
 - .4 Slack cable restraint system.
 - .2 SCS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
 - .3 Hanger rods to withstand compressive loading and buckling.

2.4 SRS FOR VIBRATION ISOLATED EQUIPMENT

- .1 Floor mounted equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Vibration isolators with built-in snubbers.
 - .2 Vibration isolators and separate snubbers.
 - .3 Built-up snubber system approved by SRS designer, consisting of structural elements and elastomeric layer.
 - .2 SRS to resist complete isolator unloading.
 - .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
 - .4 Cushioning action: gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.
- .2 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Slack cable restraint system.
 - .2 Brace back to structure via vibration isolators and snubbers.

2.5 SLACK CABLE RESTRAINT SYSTEM (SCS)

- .1 Use elastomer materials or similar to avoid high impact loads and provide gentle and steady cushioning action.

- .2 SCS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

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 Attachment points and fasteners:
 - .1 To withstand same maximum load that seismic restraint is to resist and in every direction.
- .2 Slack Cable Systems (SCS):
 - .1 Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.
 - .2 Use appropriate grommets, shackles, other hardware to ensure alignment of restraints and to avoid bending of cables at connection points..
 - .3 Piping systems: provide transverse SCS at 10 m spacing maximum, longitudinal SCS at 20 m maximum or as limited by anchor/slack cable performance.
 - .4 Small pipes may be rigidly secured to larger pipes for restraint purposes, but not reverse..
 - .5 Orient restraint wires on ceiling hung equipment at approximately 90 degrees to each other (in plan), tie back to structure at maximum of 45 degrees to structure.
 - .6 Adjust restraint cables so that they are not visibly slack but permit vibration isolation system to function normally.
 - .7 Tighten cable to reduce slack to 40 mm under thumb pressure. Cable not to support weight during normal operation.
- .3 Install SRS at least 25 mm from equipment, systems, services..
- .4 Miscellaneous equipment not vibration-isolated:
 - .1 Bolt through house-keeping pad to structure.
- .5 Co-ordinate connections with other disciplines.
- .6 Vertical tanks:
 - .1 Anchor through house-keeping pad to structure.
 - .2 Provide steel bands above centre of gravity.

- .7 Horizontal tanks:
 - .1 Provide at least two straps with anchor bolts fastened to structure.

3.3 FIELD QUALITY CONTROL

- .1 Inspection and Certification:
 - .1 SRS: inspected and certified by Seismic Engineer upon completion of installation.
 - .2 Provide written report to Departmental Representative with certificate of compliance.
- .2 Commissioning Documentation:
 - .1 Upon completion and acceptance of certification, hand over to Departmental Representative complete set of construction documents, revised to show "as-built" conditions.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CGSB24 GP-3a, Identification and Classification of Piping Systems.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Provide metal nameplate on each piece of equipment, mechanically fastened complete with raised or recessed letters. Include registration plates. i.e., ASTM, ULC, CSA as required by respective agencies and as specified.
- .2 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic, 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

- .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 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high black stencilled letters and directional flow arrows 150 mm long x 50 mm high.

2.4 DUCT ACCESS DOORS

.1 Provide lamicoid plates as per sub 2.2 indicating function.

2.5 VALVES, CONTROLLERS

.1 Stamped Plastic Tags (Valves) or Lamicoids (Controllers) as per 2.2 with 12 mm engraved lettering and numbers. Lamicoids to be black background with white lettering. Tags to be coloured to suit service (i.e. green for DCW).

.1 Provide Departmental Representative with tag schedule, designating number, service, setpoint, function and location of each tagged item and normal operating position of valves and controllers.

2.6 PAINTING

.1 Painting to conform to the requirements of this section and be performed by Section 09 91 23.

Part 3 Execution

3.1 GENERAL

.1 Provide ULC and/or CSA registration plates, as required by respective agency.

3.2 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 In conspicuous location to facilitate easy reading from operating floor and to properly identify equipment and/or system.

.2 Provide stand-offs for nameplates on hot surfaces and insulated surfaces.

.3 Do not insulate or paint over plates.

- .4 Rivet or screw nameplate onto equipment surface.

3.3 PIPING

- .1 Apply markers on piping as per the following locations:
 - .1 On long straight runs in open areas in the Water Treatment building, so that at least one is clearly visible from any one viewpoint in operating areas or walking aisles and not at more than 10m intervals.
 - .2 On both sides of any separation such as walls, floors and partitions.
 - .3 Where piping is concealed in pipe chase, ceiling space or other confined space, at entry and leaving points and adjacent to each access opening.
 - .4 At each piece of major equipment in run.
 - .5 At point immediately upstream of major automatically controlled valves. Where this is not possible, place identification as close to valve as possible, preferably on upstream side.
 - .6 Legend to be easily and accurately readable from usual operating areas and all readily accessible points.
 - .7 Plane of legend to be approximately at right angles to most convenient line of sight with consideration of operating positions, lighting conditions, reduced visibility of colour or legends caused by dust and dirt and risk of physical damage.
- .2 Identification Schedule
 - .1 Apply primary colours to all new and existing exposed piping within the Water Treatment Building for full length.

3.4 DUCTWORK

- .1 Paint all new ductwork with corrosion resistant paint.
- .2 Stencil over final finish only.
- .3 Locations of ductwork identification:
 - .1 On long straight runs in open areas in the Water Treatment Building so that at least one is clearly visible from any one viewpoint in operating areas or walking isles and not at more than 17 m intervals.
 - .2 Where ductwork is concealed in duct chase or other confined space, at entry and leaving points and adjacent to each access opening.
 - .3 At each piece of equipment in run.
 - .4 Legend to be easily and accurately readable from usual operating areas and all readily accessible points.

- .5 Plane of legend to be approximately at right angles to most convenient line of sight with consideration of operating positions, lighting conditions, reduced visibility of colour or legends caused by dust and dirt and risk of physical damage.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 78 10 - Closeout Submittals.

1.2 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.
- .2 Do all testing over entire operating range in accordance with most stringent conditions of this specification and standards of the following organizations:
 - .1 AABC Associated Air Balance Council.
 - .2 ASHRAE.
- .3 All TAB to be provided to the requirements of this specification.

1.3 QUALIFICATIONS OF TAB AGENCY & PERSONNEL

- .1 General:
 - .1 All work described in this section to be performed by the qualified TAB Agency.
 - .2 Agency and all personnel to be current members in good standing of AABC certified to perform specified services.
- .2 Certification:
 - .1 Submit to Departmental Representative TAB agency and personnel for approval within 90 days after award of Contract.
 - .2 Certification documentation to confirm qualifications, experience of TAB Agency personnel.
- .3 Prequalified firms:
 - .1 See Section 23 05 00 - Common Work Results - Mechanical.

1.4 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.
- .3 Co-ordinate all work specified in this Section.
- .4 Provide all facilities required by TAB Agency in order to carry out work of this Section.

1.5 START-UP

- .1 Follow start-up procedures as recommended by equipment

manufacturer unless specified otherwise.

- .2 Follow special start-up procedures specified elsewhere.

1.6 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.

1.7 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .2 Application of weatherstripping, sealing, caulking.
 - .3 All pressure, leakage, other tests specified elsewhere.
 - .4 All provisions for TAB installed and operational.
- .3 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 and in clean condition.
 - .2 Duct systems clean of debris.
 - .3 Air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 All duct cleaning is completed and accepted by the Departmental Representative.
 - .5 Correct fan rotation.
 - .6 Fire and volume dampers in place and open.
 - .7 Coil fins cleaned and combed.
 - .8 Access doors closed and duct end caps in place.
 - .9 All outlets installed and connected.

1.8 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: Plus or minus 10%.

1.9 ACCURACY TOLERANCES

- .1 Measured values to be accurate to within plus or minus 5 % of actual values.

1.10 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.

1.11 TAB REPORT

- .1 Format to be in accordance with referenced standard and standards of preliminary draft report.
- .2 Provide any changes identified in the review of the draft report and any subsequent updates identified on site during the certification and site review process.
- .3 Submit 1 digital TAB Report to Departmental Representative for approval.

1.12 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.

1.13 COMPLETION OF TAB

- .1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.

1.14 AIR SYSTEMS

- .1 General: measurements as required by referenced organization standards, including, but not limited to, following:
 - .1 Air velocity.
 - .2 Static pressure.
 - .3 Velocity pressure.
 - .4 Temperature:
 - .1 Dry bulb.
 - .2 Wet bulb.
 - .5 Cross sectional area.
 - .6 RPM.
 - .7 Electrical Power:
 - .1 Voltage.

- .2 Current draw.
- .3 Size.
- .8 Noise
- .9 Vibration.
- .10 Pressure.
- .2 Location of equipment measurements:
 - .1 Inlet and outlet of each:
 - .1 Fan
 - .1 Main branch damper and control damper
- .3 Location of system measurements at:
 - .1 Main ducts, main branches and sub-branches.
 - .2 Supply outlets.
 - .3 Exhaust inlets.
 - .4 Ducted return inlets.

1.15 FIRE DAMPER TESTS

- .1 Provide for drop test of fire dampers by removal of fusible link.
- .2 Damper to drop and seal cleanly. Where damper fails test advise Departmental Representative.
- .3 Affix seal indicating test completion, date and testing personnel to access door of FD. Where more than one access door provided affix seal to each access door.
- .4 Provide written verification of successful completion of all fire damper drop tests and submit in TAB report.

1.16 BUILDING FLUSH OUT

- .1 Advise Departmental Representative in writing when TAB completed and when the ventilation systems in the view of the TAB agent are suitable for building ventilation flush out as specified in Section 23 05 03 Mechanical Startup.

Part 2 NOT USED

Part 3 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittals Procedures.
- .2 Section 01 78 10 - Closeout Submittals.
- .3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .2 American Society for Testing and Materials International, (ASTM)
- .3 Canadian General Standards Board (CGSB)
- .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).
- .5 Underwriters Laboratories of Canada (ULC)
- .6 National Energy Code for Buildings, NECB-2011
- .7 ASHRAE 90.1-2001, Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 CONCEALED" - insulated mechanical services and equipment in hung ceilings non-accessible chases, furred spaces and crawlspaces.
 - .2 EXPOSED" - will mean "not concealed" as defined herein.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures..
- .2 Submit for approval manufacturer's catalog literature related to installation, fabrication for duct jointing recommendations.
- .3 Provide shop drawings as follows:
 - .1 Type C1 Insulation.
 - .2 Type C2 Insulation.
 - .3 Adhesives.
- .4 Provide product data or other documentation for adhesives and sealants used in that clearly shows VOC content (in g/L).

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with

Section 01 33 00 - Submittal Procedures..

- .2 Installation instructions to include procedures used, and installation standards achieved.

1.6 QUALIFICATIONS

- .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions recommended by manufacturer.

1.8 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
- .2 All components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with CAN/ULC-S102.

2.2 TYPE C-1 INSULATION

- .1 TIAC Code C-1: formaldehyde free, rigid mineral fibre board to ASTM C612 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24degC mean temperature when tested in accordance with ASTM C335.
- .3 Material: resilient inorganic glass fibers bonded by thermosetting resin mineral fibre blanket w vapor foil-scrim-kraft(FSK) facing material and vinyl vapor retarder.
- .4 Density: 72 kg/m3 minimum.
- .5 Thermal conductivity "k" shall not exceed 0.024 W/m deg.C at 24 deg.C mean temperature an a density of 72kg/m3 when tested to ASTM C 177-85(1993).
- .6 Operating temperature: to 121degC

- .7 Vapour permanence: maximum 0.02perms to ASTM E 96-00e1, Procedure A.
- .8 Vapor absorption: less than 5% by weight to ASTM C 1104/C 1104M-00. .
- .9 Mold Growth: no growth to ASTM C 1338-00.
- .10 Puncture resistance: 25 beach units to TAPPI test T803.
- .11 Listing: ULC and NFPA 90a flame spread and smoke developed 25.

2.3 TYPE C-2 INSULATION

- .1 TIAC Code C-2: formaldehyde free, mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24oC mean temperature when tested in accordance with ASTM C335.
- .3 Material: resilient inorganic glass fibers bonded by thermosetting resin mineral fibre blanket w vapor foil-scrim-kraft(FSK) facing material and vinyl vapor retarder.
- .4 Density: 24 kg/m3 minimum.
- .5 Thermal conductivity "k" shall not exceed 0.024 W/m deg.C at 24 deg.C mean temperature an a density of 24kg/m3 when tested to ASTM C 177-85(1993).
- .6 Operating temperature: to 121degC.
- .7 Vapour permanence: maximum 0.02perms to ASTM E 96-00e1, Procedure A.
- .8 Vapor absorption: less than 5% by weight to ASTM C 1104/C 1104M-00.
- .9 Mold Growth: no growth to ASTM C 1338-00.
- .10 Puncture resistance: 25 beach units to TAPPI test T803.
- .11 Listing: ULC and NFPA 90a, Can4-S102 flame spread 25 and smoke developed 40.

2.4 INSULATION SECUREMENTS

- .1 Tape: ULC listed, self-adhesive, aluminum, plain, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting, asbestos free, low VOC to the current content limits of SCAQMD Rule #1168.
- .3 Weld pins 4.0 mm diameter, 35mm diameter head, length to suit thickness of insulation. Nylon retaining clips, 32 mm square.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Aluminum, 19 mm wide, 0.5 mm thick.

2.5 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation low VOC to the current content limits of SCAQMD Rule #1168.

2.6 SELF ADHERING WEATHER PROOFING MEMBRANE

- .1 Weather barrier membrane (Self-Adhering): SBS modified bitumen, self-adhering sheet membrane complete with a reflective foil surface, and having the following physical properties:
 - .1 Thickness: 1.5 mm (60 mils).
 - .2 Vapour permeance: 2.8 ng/Pa.m².s (0.05 perms) to ASTM E96;
 - .3 Low temperature flexibility: -30°C to CGSB 37-GP-56M;
 - .4 Elongation: 40% to ASTM D412-modified.

2.7 JACKET

- .1 Canvas: 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems where specified complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards and in accordance with ANSI/NFPA 90A-1999, ANSI/NFPA 90B-1999 and ANSI/NFPA 96-1998.
- .2 Install all insulation systems including minimum insulation thicknesses to the most stringent requirements of ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings and the Canadian National Energy Code for Buildings-2011 unless otherwise noted in the insulation schedule.
- .3 Apply materials in accordance with manufacturers instructions and as indicated.
- .4 Use two layers with staggered joints when required nominal thickness exceeds 75mm.
- .5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes. Butt insulation and seal joints with lap seal adhesive; cover joint with approved FSK tape
- .6 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .7 Insulation at bolts, studs, nuts, instrumentation: bevel to permit

removal without damage to insulation or finish.

.8 Application:

.1 Type C1:

.1 exterior rectangular ducts and interior rectangular ducts greater than 400mm largest duct dimension.

.2 Type C2:

.1 round, oval ducts and interior rectangular ducts 400mm or less largest duct dimension.

.9 Fastenings:

.1 Type C1:

.1 Interior and less than 32mm thickness: 150mm bands of contact adhesive on 400mm centres and insulation secured with stainless steel wire/aluminum bands or approved equal at 400mm on centre.

.2 All exterior and greater than 38mm thickness: 150mm bands of contact adhesive on 400mm centres, pins at minimum one per 0.18m², cover retaining clip with approved FSK tape.

.2 Type C2:

.1 Interior and less than 32mm thickness insulation and 400mm maximum duct dimension: 50% minimum coverage of contact adhesive and insulation secured with aluminum bands or approved equal.

.2 All exterior and greater than 38mm thickness insulation and greater than 400mm duct dimension : 50% coverage contact adhesive, pins at minimum one per 0.18m², cover retaining clip with approved FSK tape.

.10 Jackets

.1 All exposed insulated ducts located indoors.

3.3 PROTECTION OF INSULATION DURING CONSTRUCTION

.1 Insulation is to be protected from moisture damage during all stages of construction.

.2 Where insulation is damaged due to moisture damage either prior to installation, during or subsequent to installation up to and including final inspection replace damaged insulation to the satisfaction of the Departmental Representative.

3.4 SELF ADHERING WEATHER PROOFING MEMBRANE - INSTALLATION

.1 Verify that surfaces and conditions are ready to accept the work. Notify Departmental Representative in writing of any discrepancies.

Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.

.2 Preparation

- .1 All surfaces must be sound, dry, clean and free of oil, grease, dirt, or other contaminants.
- .2 Seal all joints in ductwork to prevent air leakage.
- .3 Install FSK or foil faced insulation over ducts and mechanically fasten using weld pins and washers or cup head pins welded to ductwork as specified.
- .4 Cover washer or cup head pin with a 100mm (4") strip of membrane.
- .5 Ensure positive slope to prevent the occurrence of ponding water.

.3 Weather Barrier Membrane

- .1 Position membrane for alignment, and begin application of membrane on bottom of insulated plenum or duct returning up sides a minimum of 100mm.
- .2 Install sections of membrane on sides of plenum and return on to the top a minimum of 100mm.
- .3 Install top section, lapping down the sides 100mm.
- .4 Membrane applied to the underside of the substrate wider than 600mm (2') requires mechanical fastening. Fasten immediately after installation of membrane and seal with a 100x100 mm patch of membrane.
- .5 When membrane is entirely in place, roll membrane including seams with a counter top roller or apply pressure using a plastic tape applicator to ensure full contact.

3.5 DUCT INSULATION SCHEDULE

.1 Schedule:

- .1 O/A Systems: provide 50mm insulation for full length of outdoor air ducts from air handling unit/fans/hrv to hood/louvre or roof penetration for all air systems.
- .2 E/A Systems: provide 50mm insulation for full length of exhaust air ducts from air handling unit/fans/hrv to hood/louvre for all air systems.
- .3 C/A (Combustion air) Systems: provide 50mm insulation for full length of ducts inside the building

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 78 10 - Closeout Submittals
- .3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .2 American Society for Testing and Materials (ASTM International)
- .3 Canadian General Standards Board (CGSB)
- .4 Thermal Insulation Association of Canada (TIAC)
- .5 Underwriters Laboratories of Canada (ULC)
- .6 Model National Energy Code for Buildings, MNECB-1997.
- .7 ASHRAE 90.1-2001, Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.3 PRODUCT DATA

- .1 Submit Product Data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalog literature related to installation, fabrication and jointing recommendations.
- .3 Provide shop drawings as follows:
 - .1 Type A1 Insulation.
 - .2 Type A-2 Insulation.
- .4 Provide product data or other documentation for adhesives and sealants used in that clearly shows VOC content (in g/L).

1.4 MANUFACTURERS' INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with 01 33 00 - Submittal Procedures.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.5 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions recommended by manufacturer.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
- .2 All components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with ASTM E 84-01, Test Method for Surface Burning Characteristics of Building Materials and CAN/ULC-S102.

2.2 TYPE A-1 INSULATION

- .1 Alumina silica continuous matt.

2.3 TYPE A-2 INSULATION

- .1 TIAC Code A-2: Rigid molded calcium silicate in sections and blocks, and with special shapes to suit project requirements to CAN/CGSB-51.2-95.
- .2 Thermal conductivity "k" shall not exceed 0.059 W/m deg.C at 93 deg.C mean temperature, service temperature to 750 deg.C.

2.4 CEMENT

- .1 Thermal insulating and finish to CAN/CGSB-51.12-95, service temperature to 450 deg.C low VOC to the current content limits of SCAQMD Rule #1168.

2.5 JACKETS

- .1 Aluminum:
 - .1 Apply in accordance with CSA HA Series M1980.
 - .2 Crimped or embossed jacketing 0.6 mm thick with longitudinal slip joints and 50 mm end laps, 0.4mm die shaped fitting covers, factory attached protective liner on interior surface. Aluminum alloy straps with mechanical fasteners.
- .2 Stainless Steel:
 - .1 Stainless steel roll jacketing, T-304 prime grade to ASTM a-240, soft-annealed temper for ease in fabrication, smooth finish,

0.4mm thickness, factory attached protective liner on interior surface, stainless straps with mechanical fasteners.

2.6 INSULATION SECUREMENTS

- .1 Contact adhesive: Quick setting, asbestos free, low VOC to the current content limits of SCAQMD Rule #1168.
- .2 Tie wire: 1.5 mm diameter stainless steel.
- .3 Bands: Aluminum, 19 mm wide, 0.5 mm thick.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.
- .2 Install in accordance with TIAC National Standards and the requirements of ANSI/NFPA 90A-1999 and ANSI/NFPA 90B-1999.
- .3 Install all insulation systems including minimum insulation thicknesses to the most stringent requirements of ASHRAE 90.1--2001, Energy Standard for Buildings Except Low-Rise Residential Buildings and the Canadian National Energy Code for Buildings-1997 unless otherwise noted in the insulation schedule.
- .4 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm secured with wire or bands at 400 mm on centre intervals.

3.3 FINISHES

- .1 Metal jacket:
 - .1 Apply over insulation where specified.
 - .2 Pull up tight. Provide 25 mm overlap and secure.
 - .3 Final surface: to be clean and smooth.

3.4 PROTECTION OF INSULATION DURING CONSTRUCTION

- .1 Insulation is to be protected from moisture damage during all stages of construction.
- .2 Where insulation is damaged due to moisture damage either prior to installation, during or subsequent to installation up to and including final inspection replace damaged insulation to the satisfaction of the Departmental Representative.

3.5

.1 Schedule:

Application	Insulation Type	Thickness (mm)	Jacket
Generator Exhaust	A2	2@ 25mm	Aluminum
Generator Silencer	A2	2@ 25mm	Aluminum
Furnace Breeching	A1	2@ 25mm	Aluminum

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for electric and electronic control system for HVAC and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .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 electric and electronic control systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Product

2.1 THERMOSTAT (LINE VOLTAGE-HEATING AND COOLING)

- .1 Line voltage, wall-mounted thermostat, for cooling with:
 - .1 Full load rating: 16 A at 120 V.
 - .2 Temperature setting range: 5 degrees C to 30 degrees C.
 - .3 Thermometer range: 5 degrees C to 30 degrees C.
 - .4 Markings in 10 degree increments.
 - .5 Differential temperature fixed at 1.1 degrees C.

2.2 THERMOSTAT (LINE VOLTAGE, HEATING)

- .1 Line voltage integral electric heating thermostat with:
 - .1 Full load rating: 22 A at 120 V.
 - .2 Temperature setting range: 5 degrees C to 30 degrees C.

- .3 Single pole.
- .4 Thermometer range: 5 degrees C to 30 degrees C.
- .5 Scale markings: off-5-10-15-20-25 degrees C.

2.3 LOW LIMIT TEMPERATURE ALARM

- .1 Low limit temperature alarm with:
 - .1 Rating: 6.5 A at 240 V.
 - .2 Sensing bulb and 1.5 m long capillary tube.
 - .3 Switching action: manual.
 - .4 Temperature setting range: 0 degrees C to 15 degrees C.

2.4 WATER DETECTORS

- .1 General: microchip-based device, provides alarm on presence of water on floor, expendable cartridge sensor, internal waterproof switch, unaffected by moisture in air, self-powered
- .2 Element: gold-plated sensing probe
- .3 Electrical: 14 to 30V AC or DC source, fail-safe circuitry
- .4 Mounting legs: permit adjustment of sensing element from 0 to 12mm
- .5 Operating temp: -40 to 85degC
- .6 Output: NO & NC contacts rated at 5A @ 120VAC/30 VDC
- .7 Alarm:
 - .1 Liquid is detected
 - .2 Power is lost
 - .3 Internal failure
- .8 Conductive cable: order length as required

2.5 CONTROL DAMPER ACTUATORS

- .1 Direct mount proportional type as indicated
- .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated
- .3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater
- .4 Power requirements: 5 VA maximum at 24 V AC
- .5 Operating range: 0 - 10 V DC or 4 - 20 mA DC
- .6 Damper actuator to drive damper from full open to full closed in less than 120 seconds
- .7 End switches for interlocking with devices were indicated on drawings.
- .8 Provide weather proof enclosures on damper actuators located in the

treatment room in case of water spray.

2.6 STANDALONE ELECTRONIC CONTROLLER

- .1 General: standalone programmable electronic temperature controller capable of on/off and or modulating control based on temperature as indicated on drawings complete with integral LCD screen.
- .2 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
- .3 Furnace Controller:
 - .1 Minimum three (3) inputs for room thermostats.
 - .2 Operates furnaces on lead / standby, rotating every 168 hours (adjustable)
 - .3 A call for heat from any room thermostat to activate lead furnace.
 - .4 In event of lead furnace failure, activate standby furnace and indicate alarm at controller.
- .4 Generator Cooling Controller:
 - .1 Modulating output(s) for driving control dampers based on room temperature and setpoint.

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 electric and electronic control systems 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 DCC Representative .

3.2 INSTALLATION

- .1 Install all field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.
- .3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - 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 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 The scope of work related to Mechanical Fuel Systems is generally as follows:

Permanent Fuel Storage and Distribution System

- Construct reinforced concrete pad and steel roof structure for new 22,700 L main storage tank at new Site Services Building;
- Construct a new graded concrete fuel transfer apron complete with catch basin, heat traced underground drainage piping, and heat traced oil-water separator, for fuel spill collection;
- Supply and install Extruded Polystyrene Rigid Insulation on the underside of the oil-water separator checker plate covers;
- Construct concrete filled steel pipe bollards as indicated on drawings;
- Pick up in Whitehorse, deliver to site and install one ULC-S601, 22 700 L, double-walled, vacuum monitored, skid mounted, steel AST (supplied by Owner), including access stair/platform, vent pipes and ancillaries;
- Supply and install new seismic anchors for 22 700 L storage tank;
- Supply and install new 80mm (3”) single-wall steel fuel truck offloading piping with 95% overflow prevention valve, spill collection cabinet and ancillaries;
- Supply and install two new two submerged turbine pumps (STPs) in 22 700 L storage tank;
- Supply and install tank level gauge with display mounted adjacent to new tank fill cabinet;
- Modify main tank vent piping and supply and install 90% tank high level alarm switch with indication at Pump Control Panel;
- Supply and install new 40mm (1½”) aboveground steel STP discharge piping manifold, including bypass/return line, valves and supports at east end of 22 700 L (main) storage tank;
- Re-use and install one 1,136L ULC-S602 aboveground steel oval heating oil tank and ancillaries, removed from basement of House #9, in new Site Services Building Mechanical Room. Also supply and install new heating oil piping/tubing, including fusible link shut off valves, filters and supports in the fuel supply lines to two new furnaces in the Mechanical Room;
- Supply and install new 25mm (1”) aboveground steel piping from piping manifold at Main Storage tank, overhead along exterior of east wall of new Site Services Building, to Mechanical Room and Maintenance Building heating oil tanks, including valves, flex hose and supports;
- Supply and install one new 245 L ULC-S602 aboveground double wall steel rectangular heating oil tank in Generator Room in new Site Services Building, including new piping/tubing, fusible link shut off valve, filter and flex hoses in the fuel supply/return lines to new generator;
- Supply and install new 25mm (1”) aboveground steel piping from piping manifold at Main Storage tank, overhead into Generator Room in new Site Services Building to generator day tank, including valves, flex hoses and supports;
- Supply and install new 25mm (1”) aboveground steel piping from manifold at Main Storage Tank to one new aboveground/ underground pipe transition sump at east end of storage tank pad and approximately 120 m of new 25mm (1”) double-walled flexible underground fuel piping with 100mm (4”) flexible access pipe, as well as one new in-line

piping sump, for fuel supply to Houses #1-8 and future connection to new Customs Building;

- Supply and install new 25mm (1”) aboveground steel piping, including meter, valves, hose hanger, and 6m long, 25mm (1”) dispensing hose with camlock end connection to pipe, automatic shutoff nozzle, breakaway fitting, and swivel, at south side of main storage tank;
- Supply and install new 25mm (1”) aboveground steel piping from piping manifold at Main Storage tank to north side of existing Customs Building, including valves, cable tray and supports. Continue piping through foundation wall and connect to fill line of existing heating oil tank in the basement;
- Paint and label new steel piping;
- Supply and install fuel tank signage;
- Transfer fuel, test and commission new systems;
- Provide operating and maintenance manuals/instructions;
- Train designated CBSA personnel in fuel system operation and maintenance.

Prior to and During Site Site Services Building Construction

- Fill indoor heating oil tank at Maintenance Building prior to start of Site Services Building construction and temporarily modify fill piping to permit filling by tight fill connection at exterior of building and maintain fuel supply during construction;
- Drain, blow out and disconnect underground fuel pipe from Generator Building to Maintenance Building;
- Provide diesel fuel for operation of CBSA front end loader.

Demolition and Removal of Generator Building, House #9 and Existing Fuel Storage and Distribution System

- Fill indoor heating oil tanks that are to remain in service after demolition of existing Main Storage Tank and Generator Building (Houses #1-8, Customs Building and Maintenance Building). Provide temporary outdoor fill connections, supply fuel, and maintain heating oil tank levels to prevent heating interruptions;
- Transfer fuel, remove and dispose of one existing 22,500L aboveground single-wall steel Main Fuel Storage Tank, including tank outlet piping, underground fill piping and roof over tank;
- Remove and dispose of approximately 250 L waste diesel fuel and tank bottom sludge from the storage tank system;
- Drain fuel piping and remove and dispose of all existing indoor fuel piping in the Generator Building, including transfer pump, filters and ancillaries
- Drain, remove and dispose of underground fuel piping running between Main Fuel Storage Tank, Generator Building, Houses #1 -8, House No. 9, Customs Office and Maintenance Shop;
- Transfer fuel, remove and store for re-use one existing 1,136L aboveground steel oval heating oil tank located in basement of House #9, including drip pan and seismic restraint, fill pipe valves, flow meter and fill system controls,. Drain, remove and dispose of redundant fuel piping and ancillaries;
- Transfer fuel, remove and dispose of one existing 1,136L aboveground steel oval fuel oil tank and piping located in the Generator building, including transfer pumps, filters and generator supply/return piping;
- Remove and dispose of existing concrete containment structure for the Main Storage Tank;

- Drain and dispose of engine fluids and remove and dispose of two 62.5 kVA diesel generator sets, including batteries, battery chargers, engine exhaust systems, etc;

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control
- .2 All works and materials shall meet the requirements of the standards referenced herein, the General Instructions, and specific requirements outlined in the following sub-sections.
- .3 All petroleum equipment and ancillaries shall be CSA or ULC approved in accordance with applicable codes and regulations.

1.4 STANDARDS

- .1 Perform Work in accordance with the National Building Code of Canada, National Fire Code of Canada, the Federal Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations, CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products, Installation Code for Oil Burning Equipment CSA B139-09 (R2014), WorkSafeBC Occupational Health and Safety Regulations and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 All work shall conform to accepted industry standards, be professional in appearance and be completed to the satisfaction of the Departmental Representative.
- .3 Meet or exceed requirements of:
 - .1 contract documents,
 - .2 specified standards, codes and referenced documents.

1.5 CONTRACTOR QUALIFICATIONS

- .1 The Fuel Systems Work of this project shall be performed by a Contractor (and/or Sub-Contractor) certified as a "Petroleum Equipment Installer" by the Industry Training Authority of British Columbia. The Contractor shall provide documentation for review and approval by the Departmental Representative showing proof of similar work in the last 5 years involving all the required tasks of this project.

1.6 REMOVAL AND DISPOSAL OF FUEL TANKS AND PIPING

- .1 A work plan shall be submitted to the Departmental Representative for approval describing the Contractor's proposed methods for preparation, removal, transportation and disposal of all fuel tanks, piping, and associated waste fuel or flushing liquids, **prior** to commencement of the work.

- .2 All product to be removed shall be drained/pumped into appropriate containers and disposed of in an acceptable manner.
- .3 No hot work will be used when cutting/dismantling fuel piping.
- .4 Care shall be taken to ensure no spills of product occur during the work. Suitable oil absorbent materials, spill pans etc. shall be available to prevent any spillage of products reaching the environment.
- .5 The Contractor shall present for approval to the Departmental Representative the proposed method/location of disposal of all items.
- .6 Documentation proving acceptable disposal shall be provided to the Departmental Representative.

Part 2 Products

2.1 STEEL FUEL PIPING

- .1 Aboveground Fuel Piping and Fittings 50mm ϕ (2" NPS) and above:
 - .1 Pipe: Carbon steel, seamless, ASTM A106 Gr. B, Sch. 80
 - .2 Connections: All butt welded unless shown otherwise on drawings.
 - .3 Flanges: Carbon steel, 150 # RFSW, ASTM A105, ANSI B16.5
 - .4 Fittings: Carbon steel, BW, ASTM A234 GR. WPB ANSI B16.9.
 - .5 Gaskets: Non-asbestos, flat ring, 2mm thick
 - .6 Bolting: Stud bolts - Stud bolts – ASTM A193, Gr, B7. Nuts – ASTM A194, Gr. 2H
- .2 Aboveground Fuel Piping and Fittings 40mm ϕ (1½" NPS) and less:
 - .1 Pipe: Carbon steel, seamless, ASTM A106 Gr. B, Sch. 80
 - .2 Connections: All threaded unless shown otherwise on drawings.
 - .3 Fittings: Malleable iron, 300#, NPT.

2.2 FUEL TUBING & FITTINGS

- .1 Copper Tubing: Type "K" soft annealed copper, ASTM B68, Temper 060, 3/8" and 1/2" O.D. as per drawings.
- .2 Copper Tubing Joints: SAE 45 deg. Flare joints or brazing (with approved material having a melting point greater than 525 deg C.).
- .3 Stainless Steel Tubing: Type 316 stainless steel, ASTM A-269, seamless, fully annealed, max. RB80 hardness, 1/2" O.D. x 0.065" wall thickness
- .4 Stainless Steel Tube Fittings: Type 316 SS double ferrule compression type tube fittings.
- .5 Flexible Hoses (generator supply and return): 15 ϕ (½") nominal hose I.D., minimum 36" length, SAE 100R5 "Blue" hydraulic hose with SAE 45° female swivel ends.

- .6 S.S. Flexible Hose: 25Ø (1") Type 304 stainless steel corrugated hose and braid, NPT swivel end connections. Overall length - 450mm. CRN metal tag to be affixed to each hose.

2.3 FUEL FILTERS

- .1 Generator: 227 LPH (60 gph) maximum fuel flow rate, 103 kPa (15 psig) rated, 30 micron fuel filter, with coalescing type water separator, removable clear plastic bowl, drain valve and wall mount bracket.
- .2 Heating Furnaces: Epoxy coated galvanized steel, 15Ø (1/2") NPT fuel oil filter, rated for 40 LPH (10 gph) No. 2 fuel oil flow rate and 275 kPa (40 psig) working pressure, c/w 10 micron wool felt cartridge and viton seals.
- .3 Fuel oil loop deaerator: 200 LPH (50 gph) maximum oil flow, 80 LPH (20 gph) nozzle capacity, maximum inlet pressure 55 kPa (8psig), -7°C - 40 °C (20° – 105 °F) operating temperature range, 6Ø (1/4") NPT.

2.4 UNDERGROUND FUEL PIPING

- .1 All pipe, fittings, sumps and other components shall be compatible with a double-wall flexible petroleum piping containment system of a single manufacturer.
- .2 Flexible Access Pipe: 100Ø (4") crush resistant double layer corrugated flexible plastic conduit suitable for H-20 traffic loading.
- .3 Flexible Plastic Piping: 25Ø (1") double wall flexible underground pipe meeting CAN/ULC-S660-08 Standard for Nonmetallic Underground Piping for Flammable and Combustible Liquids.
- .4 Swivel Bolt-On Coupling: 25Ø (1") swivel bolt-on coupling, NPT, c/w permanent interstitial access port.
- .5 Piping Sumps: ribbed polyethylene pipe transition sump body approximately 112cm x 61 cm x 64 cm high, with fiberglass top and 69 cm dia. access cover.
- .6 Entry/Exit Boots: flexible entry boots on all piping, sleeves, electrical conduit etc. entering and exiting the underground sumps.
- .7 Manhole: composite manhole consisting of galvanized steel skirt with 100cm dia. (39½") fiberglass composite cover c/w recessed handle and stainless steel hold down bolts.

2.5 VALVES

- .1 Ball Valves:
 - .1 40mm (1½" NPS) and less: lever handle operated, full port, lockable, 316 stainless steel body and trim, glass filled PTFE seat and packing, female NPT ends.
 - .2 50mm (2" NPS) and above: 150# RF flanged, lever handle operated, full port, lockable, 316 stainless steel body and trim, glass filled PTFE seat and packing.

- .2 Check Valves: Wafer style swing check valve, carbon steel body, 13% CR trim, for use between 150# RF flanges.
- .3 Solenoid Valves:
 - .1 STP Discharge: two way, NC, 40Ø (1½”) NPT, Brass. body w/ Buna N seats, 208 VAC.
 - .2 Fuel Distribution: two way, NC, 25Ø (1”) NPT, S.S. body w/ Buna N seats, 120 VAC.
 - .3 Generator Fuel Supply: two way, NC, 15Ø (½”) NPT, S.S. body w/ Buna N seats, 12 VDC.
- .4 Flow Control Valve:
 - .1 800# threaded Globe Valve, ASTM A-105, WB, OS&Y, BG, to API 602
- .5 Thermal Relief Valves:
 - .1 15 Ø (½”) FNPT stainless steel spring loaded check valve, set at 7 kPa (1 psi) cracking pressure.
- .6 Fusible Link Valves:
 - .1 Fuel supply to Generator and Furnaces: FNPT brass gate valve with fusible element in hand wheel to close valve at 74°C (165°F). Size as per drawings.
 - .2 Fuel Supply to Generator Room: 40 Ø (1½”) FNPT, 74°C (165°F) fuse link, 1375 kPa (200 psig) WOG emergency valve, c/w ductile iron body, cap seat and swing arm, viton encapsulated Teflon o-ring, Teflon gasket and stainless steel spring.

2.6 SUBMERGED TURBINE PUMPS

- .1 Commercial fuel station submerged turbine pump: 1/3 HP. – 208-230V/1/60Hz, variable length (between 213 – 373 cm (84-147”)), centrifugal pump with automatic motor thermal overload protection, 50mm 2” NPT vertical discharge, , discharge check valve, pressure relief valve and viton elastomers.

2.7 DIESEL DISPENSING EQUIPMENT

- .1 Meter: 25Ø (1” NPT) in-line Mechanical Fuel Meter with push button reset, 19 to 114 LPM flow range and aluminum case material.
- .2 Drip Can: custom fabricated 5 L capacity aluminum drip can c/w nozzle holder, sight gauge and drain valve.
- .3 Dispensing Hose: 25Ø (1”) diameter, 6m (20’) long, 1030 kPa, (150 psig) working pressure petroleum dispensing hose c/w MNPT ends, electrically connected to internal S.S. hose reinforcing braid.
- .4 Dispensing Nozzle: 25Ø (1”) automatic diesel nozzle c/w hand warmer and swivel.
- .5 Breakaway Coupling: 25Ø 1” re-connectable dispensing hose breakaway with hose adapter.

2.8 PRESSURE GAUGE

- .1 4½” face, liquid filled, stainless steel case, 15Ø (½”) NPT L.M., stem mount, 0-410 kPa (0 – 60 psi) range.

2.9 MAIN STORAGE TANK FILL/SPILL CABINET

- .1 ULC-ORD 142.19 labeled, Remote-Fill AST Spill Container. 75 L, (20 USgal) capacity, 12 ga powder coated steel cabinet c/w 1 booted entry fitting, adjustable legs and base drain valve. .

2.10 MAIN STORAGE TANK LEVEL GAUGE

- .1 Hand pump-type pneumatic tank level gauge with remote dial display calibrated in litres to match main storage tank capacity, including tank air chamber, communicating copper tubing and fittings.

2.11 MAIN STORAGE TANK DECALS AND SIGNAGE

- .1 The main storage tank shall be marked in conformance with the requirements of the National Fire Code 2010 and ULC CAN-601-2007. The tank shall also be marked to satisfy the requirements of the Canadian Environmental Protection Act: Storage Tanks Systems for Petroleum Products and Allied Petroleum Products Regulation. The tank identification (EC) number will be supplied by the Departmental Representative prior to commissioning. The fill connection side of the tank (south side) shall be decaled in 4 inch tall black letters:

EC XXXXXX

DIESEL FUEL ONLY

SAFE FILL 20,300 LITRES (198 cm)

- .2 An existing decal on the stair end of the tank shall be modified to indicate maximum fill “**20,300**” litres.
- .3 250 mm x 355 mm (10” x 14”) Di-bond signs with red lettering on a white background shall be provided as follows:

LETTERING	LOCATION	QUANTITY
DANGER FUEL STORAGE NO SMOKING	At main fuel storage tank	3
CAUTION HANDLE FUEL CAREFULLY AVOID SPILLAGE	At main fuel storage tank fill connection	1
EMERGENCY SHUTOFF	At e-stop push button	1

2.12 GENERATOR DAY TANK

- .1 See Appendix A.

Part 3 EXECUTION

3.1 THREADED PIPING

- .1 Threaded joints shall have clean-cut threads and be reamed clean. Joints shall be made using an approved pipe compound.

3.2 WELDING

- .1 Do work in accordance with API 1104 and Section 23 05 17 - Pipe Welding
- .2 Make joints in accordance with manufacturer's recommendations.
- .3 Use bevelling machine to produce bevel cuts.
- .4 Electrodes: to CSA W48.1.
- .5 Welds: full penetration.
- .6 Replace welds which fail to meet API 1104 requirements.

3.3 CLEANING OF PIPE

- .1 Each length of pipe must be internally swabbed before being tied into the line. Contractor shall take all precautions to ensure that each pipe length is kept as free of dirt and other foreign materials as is practicable. Open ends of installed pipe shall be securely closed on completion of each day's work and shall not be opened until work is resumed.
- .2 Any obstructions, which may occur in the line, shall be removed by the Contractor and the line must be delivered to the Owner entirely free from water, dirt and other foreign substances. If for any reason, water, dirt, or foreign substances enter the line, it shall be taken apart, examined, cleared and replaced at the Contractor's expense.

3.4 FLEXIBLE UNDERGROUND PIPING INSTALLATION

- .1 Flexible underground piping shall be installed in accordance with the manufacturer's instructions. No mechanical piping joints shall be buried. Piping shall be installed with a continuous slope towards sumps ie: no dips or low points between sumps.
- .2 Connections to other piping materials shall be made by the use of NPT threaded adapters or flanges, approved for use by the piping manufacturer.

3.5 TESTING OF STEEL PIPE

- .1 Tank fill piping shall be hydrostatically tested at 1030 kPa (150 psig). Fuel distribution piping shall be pneumatically tested to 410 kPa (60 psig). Minimum test time shall be two hours. The pressure must not drop more than 15 kPa (2 psi) during this period, otherwise the leak source must be located, remedied and a retest performed.
- .2 The Contractor shall isolate the pump, tank, filter, solenoid valve and all other sensitive items rated lower than the test pressure. Records shall be made of each system tested and

shall include date of test, identification of piping tested, test medium, test pressure, test temperature, signature of person responsible and the Departmental Representative.

- .3 Testing shall be performed before any coatings are applied. Contractor shall lay out and perform all pressure testing activities, including installation and removal of test blinds and test gaskets to isolate equipment, and shall furnish and install all hoses, tools, gauges, recorders and equipment required to make the tests. Cleaning of the lines shall be performed before testing. All tests shall be carried out in the presence of the Departmental Representative.
- .4 Corrections including, but not limited to, tightening or remaking of threaded connections, cleaning of plugged lines and removal of debris, shall be done by the Contractor, at his expense, to the satisfaction of the FNESS Representative.

3.6 TESTING OF DOUBLE WALL FLEXIBLE UNDERGROUND PIPING

- .1 The Contractor shall isolate pumps, tanks, filters, dispensers and all other sensitive items rated lower than the test pressure. All testing shall be conducted with piping fully visible (i.e. not backfilled).
- .2 Primary piping shall be pneumatically tested to 410 kPa (60 psig). Cycle test pressure 5 times (from 0 to 410 kPa) and hold pressure for two hours. The pressure must not drop more than 15 kPa during this period, otherwise the leak source must be located, remedied and a retest performed.
- .3 Pneumatically test the secondary jacket of the pipe by charging to 35 kPa (5 psig), not to exceed 70 kPa. Soap all air test boots and allow one hour without loss in pressure. Leave 5 psig pressure on the secondary jacket during backfill.
- .4 All tests shall be carried out in the presence of the Departmental Representative. Corrections including, but not limited to, tightening or remaking of threaded connections, cleaning of plugged lines and removal of debris, shall be done by the Contractor, at his expense, to the satisfaction of the Departmental Representative.
- .5 Records shall be made of each system tested and shall include date of test, identification of piping tested, test medium, test pressure, test temperature, signature of person responsible and Departmental Representative.

3.7 TESTING OF FLEXIBLE UNDERGROUND ACCESS PIPING

- .1 Pneumatically test 100 (4") access pipe by charging to 15 kPa (2 psig), not to exceed 35 kPa. Soap all air test boots and allow one hour without loss in pressure. Leave 15 kPa pressure on the access pipe during backfill.

3.8 TESTING OF SUMPS

- .1 Place 70 kPa (10 psig) pneumatic pressure on the primary u/g piping and 35 kPa 5(psig) pneumatic pressure on the secondary u/g piping and 15 kPa (2 psig) pneumatic pressure on the u/g access piping.
- .2 Fill the sump with water at least 150mm above the highest (side) bulkhead fitting and check all mechanical fittings for bubble leaks and water leakage outside the sump. A drop

of greater than 5mm in water level in the sump over an 8 hour period is unacceptable necessitating repairs and a retest. When sump test is complete, remove all the test water from the sump.

3.9 TESTING OF FUEL OIL TUBING

- .1 All piping/tubing running between auxiliary supply tanks and heating furnaces and generator shall be tested by visual inspection for leaks during commissioning, both when the system is operating at full flow rate and when shut down. Minimum operating test time shall be one hour.

3.10 PAINTING

- .1 New steel piping and all miscellaneous steel members (pipe supports, etc.) shall be properly cleaned and painted per the following painting specification:
 - .1 Surface Prep.: Prepare surfaces to be coated to conform to SSPC SP6 Commercial Blast Cleaning with a minimum 1 to 3 Mils Angular Surface Profile
 - .2 Coatings: Apply one coat of Epoxy Mastic at 6-8 Mils DFT
Apply one coat of two component acrylic aliphatic urethane urethane at 3-5 Mils DFT.
 - .3 Colour: White
- .2 Main Storage Tank and stairs shall be properly cleaned and painted per the following painting specification:
 - .1 Prepare all areas showing bare metal and corrosion to conform to SSPC SP2/SP3 Hand/Power Tool Cleaning.
 - .2 Brush/Roll one coat of primer at 1-2 Mils Dry Film Thickness to all areas to be coated.
 - .3 Spot Prime/Stripe Coat with one coat of Epoxy Mastic at 4-6 Mils DFT to previously prepared bare/corroded areas and to all welds, sharp edges and bolt heads and others area difficult to coat.
 - .4 Apply one coat of two component acrylic aliphatic urethane at 3-5 Mils DFT.

3.11 PIPE IDENTIFICATION

- .1 Provide pipe identification labels to clearly identify all piping and the direction of flow in the piping.
- .2 Apply pressure sensitive markers in accordance with manufacturer's recommendations with complete wrap around.
- .3 Any markings showing dog ears, bubbles or other failings shall be replaced.
- .4 Apply pipe legend and arrow indication for each pipe run. Apply pipe legend and arrow indication within 80 mm of each valve to show proper identification of pipe contents and direction of flow.

- .5 The legend shall be applied to the pipe so that the lettering is in the most legible orientation. For overhead piping, apply so that the legend may be read from floor or ground level.

3.12 SIGNAGE

- .1 Provide pipe identification labels to clearly identify all piping and the direction of flow in the piping.
- .2 Apply pressure sensitive markers in accordance with manufacturer's recommendations with complete wrap around.
- .3 Any markings showing dog ears, bubbles or other failings shall be replaced.
- .4 Apply pipe legend and arrow indication for each pipe run. Apply pipe legend and arrow indication within 80 mm of each valve to show proper identification of pipe contents and direction of flow.
- .5 The legend shall be applied to the pipe so that the lettering is in the most legible orientation. For overhead piping, apply so that the legend may be read from floor or ground level.

APPENDIX A

GENERATOR DIESEL DAY TANK

Capacity:	245 litres (54 IGAL), One (1) tank required
Orientation:	Rectangular as detailed on drawing 43-155-401 Dimensions to be verified by the manufacturer. Maximum allowable width and length to be 460mm x 660mm (18" x 26").
Material:	Steel
Support:	Integral steel legs c/w bolt down pads
Standard:	ULC Can-S602 labelled as per current standard
Style:	Double-walled, 110% containment
Nozzles:	As per Fitting Schedule on Drawing 43-155-401
Painting (Exterior):	All tank surfaces including, sub frame and attachments shall be prepared and painted to the following minimum requirements: Surface preparation: SSPC - SP 6, Commercial Blast Clean Coatings: 1 coat 2.0 – 3.0 mils DFT of Organic Zinc primer 1 coat 2.0 – 4.0 mils DFT of Cross-linked Epoxy Amine 1 coat 3.0 – 5.0 mils DFT two component acrylic aliphatic urethane
Seismic Restraints	Tank manufacturer shall provide seismic anchors, designed to comply with the National Building Code 2010, and certified by a Professional consultant registered in the Province of British Columbia, for mounting tank to concrete pad.
Decals:	The tank shall be marked in conformance with CPPI, "Using the CPPI Colour-Symbol System to Mark Equipment and Vehicles for Product Identification" as well as any requirements of the National Fire Code and ULC CAN-S602.

Product Identification Markings:

Format for tank fill height marking (use 50 mm lettering for following):

DIESEL

VOLUME 245 L

* The location of this text on the tank will be advised later

Shop Drawings

As per Section 01 33 00 – Shop Drawings, Product Data and Samples.

Fabrication of the tank shall not proceed until one set of approved shop drawings is received.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A 480/A 480M-94b, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A 525M-91b, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process. (Metric).
 - .3 ASTM A 621/A 621M-92(1993), Specification for Steel Sheet and Strip, Carbon, Hot-Rolled, Drawing Quality.
- .2 National Fire Protection Agency (NFPA)
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 1985.
- .4 ASHRAE Handbook, Fundamental, and Systems Volumes.

1.3 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.

1.4 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated duct work in hung ceilings non-accessible chases, furred spaces and crawlspaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.

Part 2 Products

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

MAX PRESSURE (Pa)	SMACNA SEAL CLASS
500	B

- .2 Seal classification:

- .1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

2.2 SEALANT

- .1 Concealed: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 deg.C to plus 93 deg.C.
- .2 Exposed: latex duco sealant. Temperature range of minus 30degC to plus 93degC.
- .3 All sealants to be low VOC to the current content limits of SCAQMD Rule #1168.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows: short radius.
- .3 Square elbows: to 400 mm with single thickness vanes.
- .4 Square elbows: over 400 mm with double thickness vanes.
- .5 Main supply duct branches with balancing damper. Provide branch dampers as noted.
- .6 Sub branch duct with 45 deg. entry and balancing damper on branch unless otherwise noted.
- .7 Transitions unless otherwise noted:
 - .1 Diverging: 20 deg. maximum included angle.
 - .2 Converging: 30 deg. maximum included angle.
- .8 Offsets: to SMACMA unless otherwise noted.
- .9 Obstruction deflectors: maintain full cross- sectional area. Maximum included angles as for transitions unless otherwise noted.
- .10 Exposed spiral duct joints: Butt joint as per details to satisfaction of Departmental Representative.

2.6 FIRESTOPPING

- .1 Retaining angles around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.

- .3 Joints: to SMACNA.
- .4 Round:
 - .1 Exposed and concealed 250dia and larger: single spiral wound.
 - .2 Concealed less than 250dia: snap lock acceptable alternate.
 - .3 All exposed: double spiral wound.

2.8 HANGERS AND SUPPORTS

- .1 Hidden ducts:
 - .1 Round to 500dia and rectangular to 300x200 strap hangers of same material as duct but next sheet metal thickness heavier.
 - .2 Rectangular ducts larger than 300 x 200 galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA except where SRS required provide angle hangers to SMACNA.
 - .3 For round ducts 700dia and larger double hanger hanger with formed 6mm thk steel saddle.
- .2 Exposed ducts: angle hangers for rectangular,
 - .1 Rectangular: angle hangers
 - .2 Round ducts 400 dia and smaller see details.
 - .3 Round ducts greater than 400dia double hanger with formed 6mm thk steel saddle. Where SRS required for ducts over 700dia provide angle hangers.
- .3 Angle hangers to meet the requirements of the following table:

DUCT SIZE (mm)	ANGLE SIZE (mm)	ROD SIZE (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50x50x6	10

- .4 General hanger installation: to SMACNA unless otherwise noted.

2.9 UPPER ATTACHMENTS

- .1 Steel channel, joist or angle (bottom):
 - .1 Malleable iron C clamp to ANSI/MSS SP-58-1983, type 23. ULC listed.
 - .2 Quick clip malleable steel with threaded rod insert.
- .2 Steel channel, joist or angle (top):

- .1 Malleable iron top of beam C clamp to ANSI/MSS SP-58-1983, type 19. ULC listed.
- .2 Quick clip malleable steel with threaded rod insert.
- .3 Concrete:
 - .1 Insert type expanding anchor with 10dia internal threaded rod connection, galvanized steel, CSTB approved. ULC listed.

2.10 MIDDLE ATTACHMENT (ROD)

- .1 Electro-galvanized carbon steel threaded rod material to MSS SP58.

2.11 FLEXIBLE DUCTS

- .1 Factory fabricated spiral wound flexible aluminum with flame spread rating not exceeding 25 and smoke rating not exceeding 50.
- .2 Maximum length: 900mm

2.12 JOINT BEAUTY RINGS

- .1 Beauty rings to be 22 ga x 75 mm width with flanged and bolted tightening tab.

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with SMACNA and as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with ASHRAE and 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.

3.2 DUCTWORK ROUTING & SITE REVIEW

- .1 Duct work routing as shown on drawings is schematic. Provide all necessary ductwork offsets and fitting in order to route ductwork as indicated within the mechanical drawings.
- .2 Verify ductwork routing by review of mechanical and structural steel/ architectural drawings prior to ordering and shipping major ductwork elements.
- .3 Where a minor conflict between ductwork and other mechanical or electrical services occurs the conflict is to be resolved by rerouting the service that requires the lesser amount of work at no additional cost to the Departmental Representative.
- .4 Where a conflict between ductwork and the building structural elements occurs that could have been identified prior to ordering and

shipping the duct work elements provide the required remedial work at no additional cost to the Departmental Representative.

3.3 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE SMACNA.as follows:

DUCT SIZE (mm)	SPACING (Maximum) (mm)
To 1500	3000
1501 and over	2500

- .4 Support flexible ducts on 1200 mm centres.

3.4 WATERTIGHT DUCT

- .1 Provide watertight duct for:
 - .1 outdoor air intake ducts from hood/louvre to air system (AHU, HRV, CF).
 - .2 exhaust air ducts from hood/louvre to air system (AHU, HRV, EF).
- .2 Form bottom of horizontal duct without longitudinal seams. Solder joints of bottom and side sheets. Seal other joints with duct sealer.
- .3 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve and discharging as indicated.

3.5 SEALING

- .1 Concealed ducts: Apply sealant to outside of duct joint to manufacturer's recommendations.
- .2 Exposed ducts: Apply silicone sealant to satisfaction of Departmental Representative. Sealant to be suitable for painting. See Arch. In lieu provide standard duct sealant and beauty rings.

3.6 TAPING

- .1 Acceptable at connection between flexible ducts and rigid. Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.7 SERVICE ACCESS DOORS

- .1 Provide duct service access doors as follows:
 - .1 To ensure that any section of duct is not more than 15m from the service access.
 - .2 At the base of all main risers.
 - .3 Upstream and downstream of the following:

- .1 Turning vanes.
- .2 At all fire/smoke and motorized dampers.

3.8 JOINT BEAUTY RINGS

- .1 Provide beauty rings on all exposed duct joints as per sub 3.5 when standard duct sealant used. Beauty rings to be 22 ga x 75 mm width with flanged and bolted tightening tab. Install tab to be hidden from occupied space.

3.9 DUCT PROTECTION DURING CONSTRUCTION

- .1 Store all sheet metal prior to installation to protect them from moisture or dust damage as specified in Section 01 61 00 - Common Product Requirements.
- .2 Where terminal units have been contaminated by moisture or dust damage clean to the satisfaction of the Departmental Representative.
- .3 Seal off all supply, return and exhaust air system openings to prevent the accumulation of dust and debris in the systems at all times unless work is being completed on the immediate area of the system using plastic seals to the approval of the Departmental Representative. This is to include overnight and longer work stoppages. Seal all until ventilation system openings until testing, adjusting and balancing commences.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.

1.4 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.

Part 2 Products

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame 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 deg.C to plus 90 deg.C, density of 1.3 kg/sq.m.

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.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: 2 sash locks complete with safety chain.
 - .2 301 to 450 mm: 4 sash locks complete with safety chain.
 - .3 451 to 1000 mm: piano hinge and minimum 2 sash locks.
 - .4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides.

2.4 TURNING VANES

- .1 Factory or shop fabricated single thickness and double thickness with trailing edge, to recommendations of SMACNA 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.

Part 3 Execution

3.1 INSTALLATION

- .1 Flexible connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets of furnaces.
 - .2 Inlets and outlets of in-line EF.
 - .3 Inlets and outlets of generator.
 - .4 Elsewhere as indicated.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 25 mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on each side of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access doors:
 - .1 Size:
 - .1 630 x 350 mm for person size entry.

- .2 530 x 530 mm for servicing entry.
- .3 300 x 150 mm for viewing.
- .4 As indicated.
- .2 Location:
 - .1 Upstream and downstream at fire and smoke dampers.
 - .2 Upstream and downstream at control dampers.
 - .3 Upstream and downstream at turning vanes.
 - .4 At devices requiring maintenance.
 - .5 At locations required by code.
 - .6 At reheat coils, upstream and downstream of coil.
 - .7 Elsewhere as indicated.
- .3 Turning vanes:
 - .1 Install in accordance with recommendations of SMACNA and as indicated.
- .1 Instrument test ports:
 - .1 Install in accordance with SMACNA and as per manufacture instructions.
 - .2 Locations: At inlet and outlet Furnace, main and sub main ducts.

END OF SECTION

Part 1 General

1.1 RELATED SECTION

- .1 Section 13 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate the following:
 - .1 Single blade dampers.
 - .2 Multiple blade dampers.

Part 2 Products

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 BALANCING DAMPERS (DUCTS LESS THAN 275mm DEPTH)

- .1 Single blade, butterfly type.
- .2 Metal thickness and construction to SMACNA.
- .3 10dia threaded rod, with washer and locking nut, 22mmODx14mmIDx required length PVC sleeve for insulated ducts.
- .4 Continuous MIG welded 10dia angle rod handle continuous for full length.
- .5 Handle to extend minimum 50mm from duct wall/insulation for uninsulated and insulated ducts to 25mm thickness and 25mm from insulation for 50mm thickness insulation.

2.3 BALANCING DAMPERS (DUCTS 240mm OR GREATER IN DEPTH)

- .1 Factory manufactured of material compatible with duct.
 - .1 Opposed blade configuration, metal thickness and construction to recommendations of SMACNA.
- .2 Maximum blade height: 100 mm.
- .3 Bearings: self-lubricating nylon.
- .4 Linkage: shaft extension with locking quadrant.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 BACK DRAFT DAMPERS

- .1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted, locate as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
- .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.
- .7 Install where indicated.
- .8 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .9 For supply, return and exhaust systems, balancing dampers are to be located in each branch duct.
- .10 Each grille, register and diffuser connection to have balancing damper located as close as possible to main ducts.
- .11 Provide BDD for all EF & utility fans not provided with control dampers unless otherwise noted or where not allowed by code.
- .12 Provide BDD on furnace supply air outlets as indicated on drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittals.

Part 2 Products

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 ALUMINUM INSULATED/THERMALLY BROKEN DAMPERS

- .1 Frame: extruded 6063T5 aluminum, 2.03mm thick, 101.6mm deep, insulated with styrofoam on three sides for duct mounting and four sides for flanged mounting.
- .2 Blades: extruded 6063T5 aluminum, internally insulated with expanded polyurethane foam, thermally broken, minimum insulation value 0.4RSI, opposed blade
- .3 Blade and Frame Seals: extruded silicone secured in integral slot with aluminum extrusions.
- .4 Bearings: celcon inner bearing, 11mm aluminum hexagon blade pin, polycarbonate outer bearing.
- .5 Linkage: frame side, aluminum and corrosion resistant zinc plated steel with slip proof cup-point trunion screws. Blade linkage hardware to be installed out of air-stream.
- .6 Jack shaft assemblies: to be provided for multiple damper installations.
- .7 Operating temperature range: -40degC to 100degC.
- .8 Leakage: 25L/s/m² at 1kPa differential static pressure at -40degC.
- .9 Pressure drop: full open 1200x1200 damper not to exceed .007kPa at 5.08m/s.
- .10 Certification: AMCA 511.
- .11 Application:
 - .1 All O/A and E/A dampers (CD-1,2,3,5),
 - .2 CD-4,6 need not be thermally broken or insulated.
- .12 Mounting: Flanged to duct

Part 3 Execution

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

- .1 ANSI/NFPA 90A Installation of Air Conditioning and Ventilating Systems.
- .2 CAN/ULC-S112-M90, Fire Test of Fire Damper Assemblies.
- .3 ULC-S505, Fusible Links for Fire Protection Service.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate the following:
 - .1 Fire dampers.
 - .2 Fire damper mounting details.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 10 - Closeout Submittals.
- .2 Provide following:
 - .1 6 fusible links of each type.
 - .2 Spare fusible links to facilitate fire damper drop tests as required.

1.6 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 signifying adherence to codes and standards.

Part 2 Products

2.1 FIRE DAMPERS

- .1 Fire dampers: ULC listed and bear label of ULC meet requirements of territorial fire authority and ANSI/NFPA 90A-1999.
- .2 Types:
 - .1 Type 1: curtain in air stream.

- .2 Type 2: curtain out of air stream.
- .3 Fabrication:
 - .1 General: Mild steel factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .4 Top hinged: round or square; multi-blade hinge or guillotine type; sized to maintain full duct cross section unless otherwise required due to clearances.
- .5 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .6 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Coordinate with installer of firestopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.
- .8 Type 2 FD to be provided except where alternate Type 1 approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All publications below reference the most current version as of January 2015.
- .2 AMCA 99-, Standards Handbook
- .3 ANSI/AMCA 210-, Laboratory Methods of Testing Fans for Rating.
- .4 AMCA 300-, Reverberant Room Method for Sound Testing of Fans.
- .5 AMCA 301-, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .6 ANSI/ASHRAE 51-, Laboratory Methods of Testing Fans for Rating.
- .7 CAN/CGSB-1.181-, Coating, Zinc Rich, Organic, Ready Mixed.
- .8 CSA C22.2-Fans & Ventilators.

1.2 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data to include fan curves and sound rating data, showing point of operation.
- .3 Indicate the following: motors, wheels, bearings, shafts, inlet vanes.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 33 00 - Submittal Procedures.

1.4 MAINTENANCE MATERIALS

- .1 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.

1.5 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 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .2 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal .

- .3 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter .
- .4 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet safety screens and inlet dampers and vanes as indicated.
- .5 Factory primed before assembly in colour standard to manufacturer.

2.2 ELECTRICAL ROOM COOLING FAN CF-1

- .1 Housing: corrosion resistant galvanized steel complete with designer grille.
- .2 Impeller: polypropylene, forward curved wheel.
- .3 Motor: CSA listed open drip-proof with thermal overload, permanently lubricated sleeve bearings, vibration isolators.
- .4 Arrangement: ceiling exhaust.
- .5 Capacity: per schedule.
- .6 Electrical: per schedule.
- .7

2.3 CHLORINE ROOM EXHAUST FAN EF-1

- .1 Housing: spun aluminum complete with polyester coating suitable for protection against chlorine vapors, four-point mounting capability.
- .2 Impeller: aluminum, backwards inclined, non-overloading.
- .3 Motor: CSA listed direct drive with thermal overload with sleeve bearings, shock mount vibration isolators. Motor to be EC type complete with remote dial for speed adjustment.
- .4 Arrangement: in-line, centrifugal.
- .5 Capacity: per schedule.
- .6 Electrical: per schedule.
- .7 Disconnect switch: NEMA 1 toggle disconnect within fan housing.

Part 3 Execution

3.1 FAN INSTALLATION

- .1 Install fans as indicated and as per manufacturer's latest instructions, complete with vibration isolation.
- .2 Install fans with 100 mm flexible connection on inlet ductwork and on discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan during running.
- .3 Install fan restraining snubbers as indicated.

- .4 Flexible connections shall not be in tension when fan running.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate the following:
 - .1 Capacity
 - .2 Throw and terminal velocity
 - .3 Noise criteria
 - .4 Pressure drop
 - .5 Neck velocity
 - .6 Details of custom manufacturer
 - .7 Finish

1.3 MANUFACTURED ITEMS

- .1 Grilles, registers and diffusers shall be product of one manufacturer for a specified service.

Part 2 Products

2.1 GENERAL

- .1 Where duct cover required as noted on schedule, cover to be by same manufacturer as diffuser.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place and provide concealed safety chain on each grille, register and diffuser and elsewhere as indicated.
- .4 All prime coated grilles and diffusers to be painted to match Architectural finishes.
- .5 All grilles and diffusers to be all aluminum construction unless otherwise noted.

- .6 Provide grille/diffuser mounted dampers where indicated on drawings.
All dampers to be finished in colour determined by architect.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM E 90-02, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - .1 SMACNA HVAC Duct Construction Standards.
- .4 Society of Automotive Engineers (SAE)
- .5 AMCA-Air Movement and Control Association Inc.

Part 2 Products

2.1 LOUVERS

- .1 100mm deep aluminum with blades on 40 degree slope with double drainable blade and drainable heavy channel frame, birdscreen with 19mm square mesh.

2.2 BIRD SCREEN

- .1 Screen: 19 mm mesh of 2 mm diam wire aluminum bird screen.
- .2 Frame: formed U-frame of galvanized angle, minimum 18ga with intermediate supports, maximum unsupported dimensions 600mm.
- .3 Fabrication: welded.
- .4 Mounting: duct mounted angle frame on all sides except access to allow slide in/out removal of screen for maintenance purposes.
- .5 Access door: full height duct access door 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, neoprene gasket, sash locks and piano hinge.

Part 3 Execution

3.1 INSTALLATION

- .1 In accordance with manufacturers and SMACNA recommendations.
- .2 Coordinate flashings and counter flashings with architectural.

- .3 Anchor securely into opening. Seal with caulking around to ensure weather tightness.
- .4 All curb mounted hoods to be provided with additional angle mounting. Provide min 32x32x3 additional angle screwed to hood and roof curb to secure hood.

3.2 BIRD SCREEN

- .1 Provide duct mounted birdscreen for all E/A and O/A ducts where birdscreen or insect screen not supplied on louvers or hoods.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittals.
- .2 Clearly indicate following:
 - .1 Methods of expansion.
 - .2 Details of thimbles.
 - .3 Base and intermediate supports.
 - .4 Guy details.
 - .5 Rain caps.
 - .6 Flange details.

1.2 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 01 33 00 - Submittals.

1.3 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.

Part 2 Products

2.1 BREECHINGS & HEADER

- .1 Shop fabricated mild steel, welded, with sweep bends from boiler outlet to chimney as indicated. Thickness as per SMACNA HVAC Duct Construction Standards.

2.2 TYPE "A" FURNACE CHIMNEY

- .1 ULC labelled, 760 degrees C rated, all fuels.
- .2 Sectional, prefabricated, double wall with 50mm thickness mineral wool insulation with mated fittings and couplings.
 - .1 Liner: type 304 stainless steel.
 - .2 Shell: type 304 stainless steel.
 - .3 To be complete with base cleanout mounted on lateral tee.

2.3 GENERATOR EXHAUST PIPING

- .1 Schedule 40 welded steel, insulated.
- .2 Flexible pipe connection: as provided by the generator manufacturer
- .3 Silencer: insulated mild steel all welded construction with high

temp paint and flange connections to ANSI#150, hospital grade (35-40 dBa).

2.4 ACCESSORIES

- .1 See drawings for details of required accessories.
- .2 Cleanouts: bolted, gasketed type, full size of breeching, as indicated to SMACNA.
- .3 Hangers and supports: in accordance with recommendations of SMACNA and as indicated.
- .4 Rain cap as indicated.
- .5 Flange connections at boiler discharge and chimney connections.

2.5 FLUE BAROMETRIC DAMPERS

- .1 ULC/UL listed for service.
- .2 Saddle mounting, dimension breeching diameter.

Part 3 Execution

3.1 INSTALLATION

- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Suspend breeching at maximum 1.5 m centres and at each joint.
- .3 Support chimneys at bottom, roof and intermediate levels as indicated.
- .4 Install radiation shields where penetrating roof, floor and ceiling.
- .5 Install flashings on chimneys penetrating roofs, as indicated.
- .6 Install rain caps and cleanouts on all chimneys.
- .7 Install barometric dampers, as indicated.
- .8 Install generator exhaust complete with flexible connection at the generator and as required by the manufacturer on the horizontal run. Install silencer as noted on drawings and as per manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 American National Standards Institute (ANSI)/CSA Group
 - .1 ANSI Z21.47/CSA 2.3-12, Gas-Fired Central Furnaces.
- .3 CSA Group
 - .1 CGA 3.2-, Industrial and Commercial Gas-Fired Package Furnaces.
 - .2 CSA B139-09, Installation Code for Oil Burning Equipment.
 - .3 CSA B140.2.1-, Atomizing- Type Oil Burners.
 - .4 CSA B140.2.2-, Pressure Atomizing Oil Burner Nozzles.
 - .5 CAN/CSA-B140.4-, Oil-Fired Warm Air Furnaces.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for furnace units and parts 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 British Columbia, Canada.
 - .2 Submit manufacturer's written recommendations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide spare parts as follows: Burner.
- .3 Extra Stock Parts:
 - .1 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply 1 complete set of filters for each filter unit or filter bank.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect furnaces from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Product

2.1 GENERAL

- .1 Provide CSA approved, packaged factory assembled unit consisting of cabinet, fan, fan motor, intake/exhaust assembly, heat exchanger, combustion chamber, burner, controls, air filter, condensate drain.

2.2

- .1 High efficiency level range: >84%.
- .2 Certification of components and construction of factory assembled oil-fired unit: to CAN/CSA-B140.4.

2.3 CAPACITY

- .1 Output, airflow rate, static pressure, electrical requirements: per drawing schedule.

2.4 TYPE

- .1 Upflow type with oil burner.

2.5 CABINET

- .1 1.0 mm thick minimum steel with baked enamel finish.
- .2 Welded steel base for floor type.
- .3 Easily removed and secured access doors for components requiring service.
- .4 Thermally insulated cabinet.

2.6 HEAT EXCHANGER

- .1 Primary: heavy duty aluminized steel tube with aluminum fins.
- .2 Secondary: aluminized steel tube with stainless steel fins.
- .3 Warranty: non-prorated 10 years.

2.7 COMBUSTION CHAMBER

- .1 Power vent, induced draft: to manufacturers standard.
- .2 Sealed type: 100% outside air, to ANSI Z21.47/CSA 2.3.

2.8 CIRCULATION BLOWER MOTOR ASSEMBLY

- .1 Blower: centrifugal type:
 - .1 Statically and dynamically balanced.
 - .2 Rubber mounted.
 - .3 Speed adjustment: adjustable V-belt sheave.
 - .4 Wiring adjustment of multi-speed motor.
- .2 Motor: ECM variable speed, overload protection, adjustable mounts.

2.9 AIR FILTER(S)

- .1 Filter(s): 25 mm thick, cleanable, permanent type.

2.10 HEATER BURNER

- .1 General: to bear CSA and ULC labels.
- .2 Oil burner:
 - .1 High pressure atomizing type, certified to CSA B140.2.1.
 - .2 Pressure atomizing oil burner nozzle, certified to CSA B140.2.2 and flame retention head.
 - .3 Single stage fuel pump.

2.11 CONTROLS

- .1 General: conform to CSA C22.2 No.24.
- .2 Oil firing;
 - .1 Operating controls: set-back thermostat, fan operating control switch with continuous operating switch, solenoid oil delay valve, burner, draft control.
 - .2 Safety controls; flame safeguard-cadmium sulphide sensor, fan high limit control switch.
 - .3 Automatic flue-pipe damper: to CSA B140.14.

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 fuel-fired furnaces 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 in accordance with manufacturer's instructions, regulations of authorities having jurisdiction and to Canadian Electric Code.
- .2 Co-ordinate with Concrete Division regarding concrete bases as indicated.
- .3 Provide Departmental Representative written report of test results.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - 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 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This Section covers items common to Sections of Divisions 26, 27 and 28. This section supplements requirements of Division 1.
- .2 For the proper execution of work, cooperate with other trades and contracts as needed.
- .3 To avoid installation conflicts, thoroughly examine the complete set of contract documents. Resolve conflicts with Departmental Representative prior to installation.
- .4 Prior to installation of feeders to equipment requiring electrical connections, examine the manufacturer's shop drawings, wiring diagrams, product data and installation instructions. Verify that the electrical characteristics detailed in the contract documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Departmental Representative.
- .5 Examine the entire set of contract documents to avoid conflicts with other systems. Determine exact route and installation of electrical wiring and equipment with conditions of construction.
- .6 Should the electrical documents indicate a condition conflicting with the governing codes or regulations, refrain from installing that portion of the work until clarified by Departmental Representative.
- .7 Definitions:
 - .1 Provide - To furnish and install complete and ready for intended use.
 - .2 Furnish - Supply and deliver to project site, ready for unpacking, assembly and installation.
 - .3 Install - Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operation at the project site to complete items of work furnished.
- .8 All correspondence and documents shall be submitted in English. Copies in other languages shall be provided where indicated.
- .9 The entire bid package is considered related to all disciplines and shall be examined prior to bid and followed throughout construction and thereafter. Related sections listed hereinafter in this specification shall not be considered as relieving any Division from the above - indicated responsibility.
- .10 Sufficiency of drawings and specifications:
 - .1 Review the Drawings and Specifications to determine the general character and general arrangement of the Work.
 - .2 Drawings and Specifications indicate the general scope of the Project in terms of the dimensions of the Work, the type of structural, mechanical, electrical utility systems and the architectural elements of construction. The Drawings and Specifications do not necessarily indicate or describe all Work required for the full performance and completion of the requirements of the Contract Documents. On the basis of the general scope indicated, stated, described or implied, furnish all items required for the proper execution and completion of the Work.
 - .3 The Contract Documents are issued to facilitate construction by expressing

the design intent. The Drawings and Specifications do not necessarily contain all of the details required to construct the project, and contractor supplied detail in the form of detailed construction documents (referred to in the Contract Documents as the Contractors supplied shop drawings, submittals, and field coordination drawings) is required for construction of the Work; all of which set out the specific and final details required for placing and constructing the finished Work. By contrast, the Drawings and Specifications are provided to reflect the finished design of the Work. The Drawings and Specifications are not intended to be used as a set of detailed instructions on how to construct the Work. Construction means, methods, techniques, sequences, procedures, and site safety precautions are the responsibility of the Contractor.

- .4 Shop Drawings, Product Data, Samples and similar submittals provided by the Contractor are not Contract Documents. The purpose of these submittals is to demonstrate the way by which the Contractor proposes to conform to the design intent expressed in the Contract Documents.
- .5 Examine the Drawings and Specifications to satisfy yourself regarding the design intent and the extent of the proposed Work, and by personal examination of the site and surroundings make your own estimate of the facilities condition and difficulties attending the performance and completion of the Work.
- .11 Make known in writing to the Departmental Representative ten (10) days prior to the tender closing date any materials specified or is required to complete the work, which are not currently available or will not be available for use as called for herein or on drawings. Failing to do so, it will be assumed that the most expensive compliant alternate has been included in the tender price.
- .12 For the sake of clarity, electrical symbols are typically shown larger than they would be at the actual scale of the drawing. Therefore, do not scale electrical drawings. Where exact dimensions are required, refer to dimensioned architectural plans or civil drawings. Failed to do so, bear all resulted costs and make good of the work.
- .13 The general contractor who has contractual relationship with the Owner shall be responsible for providing complete and workable systems as outlined on drawings and in specifications. The Departmental Representative will not recognize any sub-contractor as such, but will consider all persons engaged on the work to be under the control of General Contractor. The Departmental Representative will not under any circumstances, enter into discussions concerning the responsibility of subtrades or the apportionment of work. No claim based on the division of work between specification sections or subtrades will be considered.

1.2 CODES AND STANDARDS

- .1 Unless otherwise indicated, all references to standards and codes throughout this specification is to the latest applicable edition at the time of bid closing.
- .2 Do complete installation in accordance with CSA C22.1, Canadian Electrical Code, Part 1. In case of a conflict between the code requirements and the contract documents, request clarification prior to proceeding with the work.
- .3 Do underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

- .4 Definitions:
 - .1 Abbreviations for electrical terms: to CSA Z85 - Abbreviations for Scientific and Engineering Terms.
 - .2 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122 - The Authoritative Dictionary of IEEE Standards Terms.
- .5 Coordinate with other disciplines and provide plenum rated equipment and devices and plenum rated raceway, wiring and installation methods in all plenum spaces.
- .6 Material and installations shall comply with the requirements of the following codes and standards, codes and standards mentioned in other sections of this specification, as well as other applicable codes and standards to the satisfaction of the Authorities Having Jurisdiction (AHJ):
 - .1 Canadian Electrical Code (CEC).
 - .2 National Building Code of Canada (NBCC)
 - .3 National Fire Code of Canada (NFCC).
 - .4 CAN/ULC-S524, Installation of Fire Alarm Systems.
 - .5 CAN/ULC-S537, Verification of Fire Alarm Systems.
 - .6 CAN/CSA-C282, Emergency Electrical Power Supply for Buildings.
- .7 Provide the site office with a current copy of the following documents, codes and standards. These documents shall remain on site throughout the duration of construction for electricians and others reference and use. The maintenance of these codes on site may be checked at each site visit. Absence of one or more such documents will be indicated on the field review report as deficiency and non-compliance with contract requirements.
 - .1 Project's electrical specifications and drawings.
 - .2 Project's up to date electrical RFIs and responses, SIs and CCNs.
 - .3 Canadian Electrical Code (CEC).
 - .4 National Building Code of Canada (NBCC)
 - .5 CAN/ULC-S524, Installation of Fire Alarm Systems.
 - .6 CAN/ULC-S537, Verification of Fire Alarm Systems.
 - .7 CAN/CSA-C282 - Emergency Electrical Power Supply for Buildings.
 - .8 CAN/CSA-Z32 - Electrical safety and essential electrical systems in health care facilities.
 - .9 British Columbia Building Code (BCBC).

1.3 QUALITY ASSURANCE

- .1 Conform to the requirements of CEC with amendments by local Authorities Having Jurisdiction (AHJ).
- .2 Conform to the requirements of the NBCC and BCBC with amendments by local AHJ.
- .3 Obtain and pay for the electrical permits, plan review and inspection from local AHJ.
- .4 Conform to the requirements of the serving electric, telephone and satellite television utilities.

1.4 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number

of drawings and specifications for examination and approval prior to commencement of work.

- .2 Pay associated fees.
- .3 Owner will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Department or Supply Authority prior to making such changes.
- .5 Furnish Certificates of Acceptance from Authorities Having Jurisdiction on completion of work to Departmental Representative.

1.5 ALTERNATE PRODUCT APPROVAL

- .1 Refer to Division 1 sections for more information.
- .2 Electrical price shall be based on the equipment specified or alternate equipment that received prior approval from the Departmental Representative before tender closing.
- .3 Requests for prior approval of alternates shall be received at the Departmental Representative's office a minimum of ten (10) business days prior to the closing date for issuing the last addendum or official response by Departmental Representative.
- .4 Request for approval shall clearly indicate the specified product and the related specification section(s) as well as a comprehensive list identifying all areas where the submitted alternative does not comply with the specifications.
- .5 Notwithstanding item 4, substitution requests shall be complete with proper support documents to clearly identify the equality of the specifications of the suggested product on an item by item basis compared to the specifications listed for the specified product. Requests not meeting this requirement, will be returned as insufficient information for review.
- .6 No substitution of items specifically called for on the drawings, such as feeders, etc., with other products- even the ones listed in specifications, is allowed without timely and proper request and approval.

1.6 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Submit to the Departmental Representative for review, shop drawings, product data and samples called for by the contract documents and for such other items as the Departmental Representative may request. Do not proceed with work until related submission has been reviewed by the Departmental Representative.
- .3 Product Data:
 - .1 Product data means standard printed information describing materials, products, equipment and systems, not specially prepared for work of this contract, other than the designation of selections.
 - .2 Product data consisting of manufacturers' standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and descriptive data will be accepted in lieu of shop drawings provided that:
 - .1 Information not applicable to the work of this contract is deleted, or the applicable information is clearly marked.
 - .2 Standard information is supplemented with information specifically applicable to work of this contract.

- .3 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Shop drawings:
 - .1 Shop drawings means technical data specially prepared for work of this contract including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form.
 - .2 Submit shop drawings presented in a clear and thorough manner to appropriately illustrate the work.
 - .3 Shop drawings shall represent existing conditions where new work is tied into existing systems and or surfaces. Shop drawings shall indicate all existing condition which affect the work. Identify field dimensions on drawings.
 - .4 Identify shop drawings by appropriate references to sheet, detail, schedule or room number. Maximum allowable drawing size 280mm x 425mm (11" x 17"). Provide a clear area of 100mm x 75mm (4" x 3") on each shop drawing for Departmental Representative's review stamp.
- .5 General:
 - .1 Review, stamp with approval and sign shop drawings before submission to Departmental Representative. Stamping and signing the transmittal only, is not acceptable. By approving and submitting shop drawings, Contractor represents that field measurements, field construction criteria, material, catalogue numbers and similar data have been verified and that shop drawings have been checked and coordinated with requirements of the work and contract documents regardless of what the stamp disclaims.
 - .2 At the time of submission, inform Departmental Representative in writing of any deviations in shop drawings from requirements of Contract Documents.
 - .3 Departmental Representative will review shop drawings for the sole purpose of ascertaining conformance with general design concept of the project and with information given in Contract Documents. Engineer's review of a separate item shall not indicate acceptance of an assembly in which the item functions. This review by Departmental Representative shall not mean that the Departmental Representative approved the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or his responsibility for meeting all requirements of the Contract documents as well as applicable federal and provincial/territorial laws, regulations and acts.
 - .4 Make corrections which Departmental Representative may require, consistent with Contract Documents, and resubmit modified shop drawings until reviewed.
 - .5 Direct specific attention in writing on re-submitted shop drawings to revisions requested by Departmental Representative on previous submissions.
 - .6 Be 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 coordination of the work of all Sections.
- .7 Shop drawings submitted in Imperial will be returned to the contractor not reviewed until they are submitted in Metric Units (SI).
 - .8 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before receiving Departmental Representative's final review.
 - .9 Boiler plate copies of manuals or drawings shall not be accepted. Shop drawings to only contain information relevant and applicable to the system as covered in these documents. It is the responsibility of the contractor or his suppliers under the contractor's supervision to filter out the boiler plate documents, select the relevant pages, mark suggested products and submit such information only. Price this effort in the bid and deliver accordingly. Non-compliant suggestions will be rejected and the consequential delay shall be the responsibility of the Contractor.
 - .10 No work requiring a shop drawing submission shall commence until the submission has received Departmental Representative's final review. All such work shall be in accordance with reviewed shop drawings.
 - .11 Provide submittals for review for all electrical material and equipment.
- .6 Shop Drawing and Product Data Submissions:
- .1 Submit one (1) copy of shop drawings electronically via email or ftp site. Ensure electronic files are legible. Departmental Representative will review and provide electronic stamp; documents returned will be in PDF format. Departmental Representative will retain a copy for their records and return a copy of shop drawings and product data to the Contractor.
 - .7 Do not resubmit shop drawings or parts thereof, which have received favorable review again independently or as part of a resubmission. The entire package will be rejected if this requirement is breached.
 - .8 Allow for ten (10) working days for the Departmental Representative to review each shop drawing submission. For submissions in excess of 50 pages, allow an extra day for each 20 pages or fraction thereof. Shop drawings to be submitted by system, and grouped wherever possible.

1.7 CONTRACT BREAKDOWN

- .1 Provide separate material and labour breakdown for the total electrical sub-contract as indicated below. This breakdown is to meet the satisfaction of the Departmental Representative and is to be submitted within 14 days of contract award.
- .2 The breakdown will be used in computing of progress claims. Progress claims are to be itemized with separate labour and material listing against each item of the contract breakdown. Progress claims will not be reviewed if they are not presented as per the following breakdown:
 - .1 Mobilization
 - .2 Service, Distribution Panelboards and Feeders
 - .3 Emergency power system
 - .4 Lighting
 - .5 Power Branch Circuitry

- .6 Fire Alarm System
- .7 Emergency and Exit Lighting
- .8 Structured Wiring
- .9 Shallow Utilites Trenching, Pipework/Cabling and Backfill
- .10 Training, O&M Manuals, Reports and Records

1.8 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 30 - Closeout Submittals.
- .2 Operation and Maintenance Data: Provide the Departmental Representative with operation and maintenance data, as follows:
 - .1 Organize contents into applicable sections of work to parallel project contract price breakdown.
 - .2 Ensure that the manuals comply with the requirements of all other sections of the contract documents.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect equipment and materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Product

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, 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 labels for control items in English.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide material in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and Material to be CSA certified. Where CSA certified are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of Consultant.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with labels as follows:
 - .1 Nameplates: plastic laminate mm melamine, black face, white core, lettering accurately aligned and engraved into core.
 - .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 to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per line.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, 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.

2.8 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.

System	Prime Colour	Auxiliary Colour
Power 120/208	Grey	Purple
Structured Wiring	White	Blue
DC Emergency Lighting	Orange	
Fire Alarm	Red	
Lighting	Blue	

2.9 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish.
 - .2 Paint indoor switchgear and distribution enclosures light gray.

2.10 FIRE STOPPING

- .1 In addition to complying with the requirements of Section 07 84 00, seal around optical fiber cables, electrical wires and cables, electrical raceways, electrical boxes and other similar building electrical services that penetrate fire separation or a membrane forming part of an assembly required to have a fire-resistant rating, with moldable fire stop putty pads or other listed and approved to CAN/ULC-S115 rated to maintain the fire resistance rating of the fire separation or assembly.
- .2 Outlet boxes that penetrate opposite sides of a wall assembly shall be offset where necessary to maintain the integrity of the fire separation.
- .3 Fire stop putty pads to be of fast installation type applied by hand, designed specifically for electrical outlet boxes in gypsum wallboard walls, non-curing with no volatile solvents and no asbestos fibers.
- .4 Provide shop drawings for all fire stop material.

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 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: rigid galvanized steel conduit, sized for free passage of conduit, and protruding 150 mm. Notify the engineer if conduit sleeves will contain unbalanced phase conductors.
- .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 AND LIGHT SWITCHES

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets and light switches 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.
- .5 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: 1200 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: 450 mm.
 - .3 Panelboards: as required by Code or as indicated. Topmost breaker no greater than 1800 mm above finished floor (AFF)

- .4 Telephone and interphone outlets: 300 mm.
- .5 Wall mounted telephone and interphone outlets: 1500 mm.
- .6 Fire alarm stations: 1200 mm.
- .7 Fire alarm signal devices: 2100 mm, and no less than 300mm below finished ceiling.

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 - Quality Control.
 - .1 Power generation and distribution system including phasing, voltage, grounding, load balancing and phase rotation.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and lighting control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: communications and fire alarm.
 - .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 where requested.
- .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 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:
 - .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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The scope of work related to Electrical Fuel Systems is generally as follows:
 - Supply and install Pump Control Panel in the Site Services Building Electrical Room, with pump selector switch, tank fill selector switch, motor starters and indicator lights. The panel shall also incorporate alarms for underground piping leak detection, main storage tank high level, oil water separator high oil level and generator day tank high level as well as remote audible/visual alarms and alarm silence pushbutton at exterior of the Site Services Building and remote emergency stop pushbutton;
 - Supply and install a leak detection/alarm system with sensors in each of the underground piping sumps. The leak detection panel shall be located adjacent to Pump Control Panel at the Site Services Building. Note: the four existing piping sumps on the east side of Houses #1-8 are presently equipped with leak sensors that report to an existing console located in one of the duplex residences. The sensors and existing conduit between those sumps and the console in duplex residence may remain but new conduit and cabling shall be installed so as to provide individual indication of alarms from those sumps, as well as the two new piping sumps, at the Site Services Building Electrical Room, i.e. not a combined alarm for multiple sumps. The alarm system shall incorporate output relay contacts wired to prevent pressurizing of the underground piping in event of a sump alarm condition;
 - Supply and install an oil/water interface monitor and control unit for level indication and alarm in the oil/water separator. (The level indicator console shall be mounted adjacent to the Pump Control Panel in the Electrical Room);
 - Modify existing fill control systems for heating oil tanks at Maintenance Building, Customs Building and Site Services Building Mechanical Room to provide secondary high level shutoff of fill line solenoid valves;
 - Supply and install electrical cabling, conduit, wire, panels, controls and ancillary equipment for new systems;
 - Transfer fuel, test and commission new systems;
 - Provide operating and maintenance manuals/instructions;
 - Train designated CBSA personnel in fuel system operation and maintenance.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.3 No. 1-01(Update March 2005), Overhead Systems.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples.
- .2 Submit certified data/shop drawings to the Departmental Representative for all equipment, accessories and control panels prior to proceeding with the work.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control
- .2 All materials and equipment must be CSA and ULC certified and labelled for the designated area classification.

1.5 CARE, OPERATION AND START-UP

- .1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of equipment.
- .2 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 all aspects of its care and operation.

Part 2 Products

2.1 CONTROL PANELS

- .1 Enclosures:
 - .1 Heavy gauge aluminum enclosure housing pump starters, selector switch, control relays, push buttons, indicator lights, terminals and wiring, generally as per drawings.
- .2 Time Delay Relays:
 - .1 Dial timing relays, multiple programmable timing ranges, pin style terminals, 10A contact rating, multi-voltage inputs, timed contacts and instantaneous contacts, multi-function (On-Delay, Off-Delay, etc.) c/w mounting base, voltage as per drawings.
- .3 Control Relays:
 - .1 General Purpose industrial type relays, pin style terminals, poles numbers as required, 10 A contact rating, standard On/Off flag indicator, electrical schematic on face, clear cover for visual inspection, coil voltage as per drawings.
- .4 Selector Switches:
 - .1 Heavy duty industrial, 30.5 mm mounting hole, metal Type 4/13 watertight/oiltight, number of selectable positions as per drawings, standard knob operator, maintained operator function, contact blocks as required, 10A contact rating, voltage as per drawings.
- .5 Pushbuttons:
 - .1 Heavy duty industrial, 30.5mm push buttons, metal Type 4/13 watertight/oiltight, flush head operator type, momentary contact action, black color cap, 10 A contact rating, contact block style and voltage as per drawings.
- .6 Pilot Lights:

- .1 Heavy duty industrial, 30.5 mm mounting hole, 10 A contact rating, metal type 4/13 watertight/oiltight, full voltage power module type, LED illuminator, lens color as per drawings.
- .7 Pump Motor Starters:
 - .1 NEMA Size 0, 1 phase , 2 pole, 600 VAC, 60 Hz, open type, motor starter with 115-120V coil, and NO auxiliary contact.
- .8 Labels:
 - .1 Lamicaid panel labels, text as indicated on drawings.
- 2.2 REMOTE HORN**
 - .1 120V, weatherproof NEMA 4X enclosure, adjustable volume horn 78 to 103 dB, temperature rated to -40°C, 400 hour rating at 50% duty cycle.
- 2.3 REMOTE STROBE**
 - .1 120V, weatherproof NEMA 4X enclosure, 40W halogen lamp, amber, flashing, temperature rated to -40°C.
- 2.4 EMERGENCY STOP PUSH BUTTON**
 - .1 120V, weatherproof NEMA type 4/13 enclosure, temperature rated to -40°C, 1 NC maintained contact, 2-position push-pull 63mm metal button, emergency stop legend plate.
- 2.5 LEVEL SWITCHES**
 - .1 Multi point, 50 Ø (2") NPT mount, stainless steel stem, Buna N Floats, actuation levels and contact arrangement as shown on drawings, separate conductors per float switch, explosion proof junction box.
- 2.6 LEAK DETECTION MONITORING CONSOLE & SUMP SENSORS**
 - .1 120V Monitoring console c/w fail safe sump leak detection sensors (i.e. if a sensor loses contact with the monitor, the monitor initiates an alarm condition), 8 sensor inputs and 2 NO/NC programmable relay dry contact outputs.
 - .2 Sump sensors:
 - .1 Non discriminating fail safe sensors, compatible with the leak detection console. Sensors to detect any liquid in sump (fuel or water).
- 2.7 OIL-WATER SEPARATOR OIL LEVEL MONITOR**
 - .1 120V, Continuous interface monitoring of static level oil/water separators for oil level indication, control and alarm
 - .2 Performance:
 - .1 Range: 0-20 feet
 - .2 Resolution: 0.1 inches of oil

- .3 Accuracy $\pm 0.2\%$ of Full Scale
- .3 Console:
 - .1 4 line X 20 Character LCD display with backlight;
 - .2 16 key membrane keypad;
 - .3 Four 10A/120VAC programmable SPDT dry relay outputs;
 - .4 Two 2 wire plus shield connection inputs.
- .4 Oil Level Probe:
 - .1 Concentrically shielded oil level capacitance probe.
 - .2 50 \O (2") NPT connection.

2.8 CONDUIT

- .1 Rigid galvanized steel conduit and fittings unless shown otherwise on drawings.
- .2 Boxes and fittings for use with galvanized steel conduit systems shall be Feraloy or equivalent.
- .3 Boxes shall have threaded hubs for conduit connections.

2.9 JUNCTION BOXES

- .1 As per CSA 22.1 and as noted on drawings (Feraloy or equivalent).

2.10 WIRE AND CABLE

- .1 Unless otherwise noted or specified, all wiring shall be copper, with RW90 X-link polyethylene insulation.
- .2 TECK 90, 600V, galvanized steel armoured cables c/w watertight connectors.
- .3 Minimum conductor size for power circuits shall be #12AWG, and for control circuits shall be #14AWG except as noted.
- .4 All conductors shall be stranded.
- .5 Cable sizing shall be as indicated on drawings, in specifications or, if not indicated, as per CSA 22.1

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 and with all other applicable provincial and local building and electrical codes except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 and in particular except where specified otherwise.

- .3 Where there is a conflict with the drawings, the above codes, rules and bylaws shall govern, but in no case shall the standards established on these drawings and specifications be reduced by any of these codes, rules or bylaws.
- .4 Equipment Installation:
 - .1 The installation of all electrical equipment shall be in accordance with the manufacturer's instructions. The Contractor is responsible for obtaining certified drawings, operating/maintenance manuals and installation instructions from the supplier at the time of purchase. The Contractor shall submit certified data/shop drawings to the Departmental Representative prior to proceeding with the work.
 - .2 Supply and install grounding and bonding systems, as shown on drawings, and in accordance with CSA 22-1, for all service panels, wiring systems, equipment enclosures, lighting and electric motors.
 - .3 Follow manufacturer's instructions unless they contradict or reduce the stipulations of these specifications, applicable codes or regulations of an authority having jurisdiction. In such cases of conflict consult the Departmental Representative for a ruling, which shall be binding.
- .5 Conduit and Cable Installation:
 - .1 Install conduit and sleeves prior to pouring of concrete.

3.2 PERMITS AND INSPECTIONS

- .1 The Contractor shall obtain all permits and licenses and arrange for the final inspection of the works with the local Provincial Electrical inspector. All costs related to the permitting, licensing and inspection(s) shall be borne by the Contractor. Certificate(s) of inspection shall be submitted to the Departmental Representative.

3.3 QUALIFICATIONS

- .1 Contractor to have qualified personnel to continuously direct and monitor all electrical work.

3.4 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.

3.5 TESTING

- .1 The Contractor shall test all wiring point to point for continuity and insulation to ground. The installation shall also be tested for proper operation prior to handover.

3.6 IDENTIFICATION

- .1 Equipment Identification:
 - .1 All equipment shall be clearly identified with lamicoid labels having minimum 3mm white letters on black background. Dymo tape labels are not acceptable.
- .2 Manufacturers' nameplates and CSA labels to be visible and legible after equipment is installed.

3.7 DELIVERY AND STORAGE

- .1 Deliver and store on site material required for the progress of the work.
- .2 All electrical equipment must be stored indoors.

3.8 DRAWINGS AND SPECIFICATIONS

- .1 Specifications and related plans establish scope, material and installation quality but do not necessarily show offsets, fittings or installation difficulty that may be encountered during the execution of the work and therefore cannot be used as a claim for any such deficiency of omission.
- .2 Where work that is obviously necessary for the operation of the system is not shown on the drawings or described in the Specifications; such work shall be carried out in a manner acceptable to the Departmental Representative at no additional cost.
- .3 It shall be the responsibility of the Contractor to study all drawings and specifications, and understand the work thoroughly, taking into consideration requirements for each trade involved.
- .4 In case of ambiguity, due to conditions at the site, information omitted or insufficient, conflict of requirements of different trades affecting the same portion of work, and so on, the Contractor shall notify the Departmental Representative in writing and obtain necessary clarification. Failure to do this prior to tendering will not relieve or provide grounds for additional costs. The Departmental Representative's decision on all matters shall be final and binding upon the Contractor.
- .5 Drawings:
 - .1 Not intended to show structural details or architectural features unless specifically noted.
 - .2 Do not scale.
 - .3 Except where dimensioned, drawings indicate general electrical only. Furthermore, proper precautions shall be exercised to verify figures shown on the drawings.
 - .4 The drawings are diagrammatic and indicate the general arrangements of the systems and work included in this Contract. Exact locations of fixtures and equipment, where same are not definitely located, must be checked with the Departmental Representative prior to the installation of same.

3.9 PROJECT RECORD DOCUMENTS

- .1 Provide as-built drawings of final installation.
- .2 Keep a set of updated construction drawings on site.

3.10 CLEANING

- .1 Clean and touch up surfaces of shop painted equipment which is marred or scratched during shipment or installation, to match original paint.
- .2 Clean, prime and paint exposed hangers, racks, fastening to prevent rusting.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International):
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC):
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

Part 2 Product

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 EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded or round solid copper conductors as required.
 - .2 Clamp for stranded or round copper conductors as required.
 - .3 Clamp for conductors.
 - .4 Stud clamp bolts.
 - .5 Bolts for copper conductors bar.
 - .6 Bolts for aluminum conductors.
 - .7 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors where aluminum is shown on drawings.
 - .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 every time the connection is removed and reinstalled.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.

Part 2 Product

2.1 BUILDING WIRES

- .1 Conductors: Copper, stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90

2.2 TECK 90 CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131..
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation: Cross-linked polyethylene type RW90 XLPE, 600V for 120/208V system.
 - .1 Ethylene propylene rubber EP.
 - .2 Cross-linked polyethylene XLPE.
 - .3 Rating: 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel..
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
 - .1 One hole malleable iron straps to secure surface cables 53 mm and smaller. Two hole steel straps for cables larger than 53 mm.
 - .2 Channel type supports for two or more cables at 1500 mm centers.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Dry type approved for TECK cable in indoor type 1 environments.
 - .2 Wet type approved for TECK cable where installed outdoors, or where installed above cabinets in sprinklered areas.

2.3 ARMoured CABLES

- .1 Conductors: insulated, copper, size as indicated. Minimum size to be #12 AWG.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: flame retardant jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.

- .5 Connectors: Standard 3/8" BX. Straight, 90, or duplex to suit application. Approved for AC cable. Provide plastic insulating bushing for all cable ends.

2.4 CONTROL CABLES

- .1 Type PLTC: Multiconductor controls cable
 - .1 Conductors: PVC insulated, PVC jacketed, copper , unshielded pair, overall shield, minimum size to be #16 AWG.
 - .2 Insulation: 105 degrees C Flame retardant PVC
 - .3 Aluminium foil/polyester shield with tinned copper drain wire.
 - .4 Jacket to be UL listed, sunlight and moisture resistant, sequentially marked, nylon ripcord for jacket removal. FT-4 Flame spread minimum, FT-6 for return air plenums.
 - .5 Conductors are to be black/white number coded, rated for 300V at 105 degrees C.

2.5 FIRE ALARM CABLE

- .1 Conductors: multiconductor, insulated, copper, minimum size to be #18 AWG for device loops and #14 for signal circuits.
- .2 Insulation: 105 degrees C Flame retardant PVC.
- .3 Outer Jacket: 105 degrees C Flame retardant PVC Red. FT-4 Flame spread minimum, FT-6 for return air plenums.
- .4 Armour: Interlocking Aluminium without overall Jacket. For drops to devices in suspended ceilings from conduit system.
- .5 Standard of Acceptance: Nexans Securex II or approved equal.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

- .1 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 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.
- .7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.2 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:

- .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Do not splice the wiring between three and four way switches inside the luminaire enclosures.

3.3 INSTALLATION OF TECK CABLE (0 -1000 V)

- .1 Install cables in trenches or on structures as indicated on drawings.
- .2 Lay cable in cable troughs in accordance with Section 26 05 36.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0-1000 V.

3.4 INSTALLATION OF ARMOURED CABLES

- .1 Armoured cables are only allowed for light fixture drops or other applications specifically indicated elsewhere within the contract documents. Use armoured cable where allowed by applicable codes.
- .2 Group cables wherever possible.
- .3 Lay cable in cable troughs in accordance with Section 26 05 36.
- .4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0-1000V.

3.5 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit
- .2 Ground control cable shield.
- .3 All costs associated with the supply and installation of low voltage control wiring for below 50V and related materials to be carried by Division 23 and 25 unless otherwise noted in the project documents.
- .4 Provide line voltage control wiring, raceway and terminations. Coordinate with Divisions 23 and 25 at the time of tender and bid accordingly. Failed to do so, provide all necessary whatsoever at no extra cost.

3.6 INSTALLATION OF FIRE ALARM WIRING

- .1 Install fire alarm wiring in conduit.
- .2 Provide grounding conductor throughout.
- .3 Use listed, armoured cable, only for drops to a device in suspended ceiling space from conduit system and for tamper and flow switches exposed wiring.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 26 05 01 Common Work Results - Electrical.

1.2 OPERATION AND MAINTENANCE DATA

- .1 Submit in accordance with Section 26 05 01 Common Work Results - Electrical.

Part 2 Products

2.1 SELF REGULATING HEATING CABLE

- .1 Lineal power density of up to 30 W/m, 120 Vac, fluoropolymer overjacket, metallic ground braid, CSA approved for wet locations.
- .2 To be complete with factory-supplied cold lead kit and end termination kit.
- .3 To be suitable for long-line applications of up to 342m.
- .4 Suitable for supply voltage range of 200-277Vac.
- .5 Self-regulating heat output that decreases as temperature increases from approximately 30W/m at -5°C to 6W/m at 65°C.

2.2 INTELLIGENT HEAT TRACING CONTROLLER

- .1 Automatic freeze protection with variable setpoint control from 2°C to 10°C (minimum range). Internal 60A contactors for control of heat tracing circuits. Adjustable ground fault protection from 6mA to 30mA.
- .2 External alarm contacts for trouble and high limit.
- .3 100 Ohm Platinum RTD sensor. Length to suit application. Field measure prior to ordering materials.
- .4 Three (3) Integral LED lamps to indicate: GFEP condition, Supply power available, Heating Cable ON.
- .5 Integral GREP test/reset button.
- .6 FRP enclosure.
- .7 Suitable for supply voltage of 208Vac.
- .8 Startup algorithms that permit current-limiting soft start.
- .9 Two-pole output relays.
- .10 Capable of controlling two heat trace circuits with separate RTD's.
- .11 Alarm monitoring control points for temperature, ground fault, current, voltage, resistance (low or high).

2.3 AMBIENT SENSING MECHANICAL CONTROLLER

- .1 Cast aluminum housing with attached temperature sensor.
- .2 Set point range that includes -5°C to 10°C.
- .3 Contact rating of up to 22A between 125V and 480V.
- .4 Fluid-filled capillary sensing bulb.

2.4 REMOTE SENSING MECHANICAL CONTROLLER

- .1 Cast aluminum housing.
- .2 Set point range that includes -5°C to 10°C.

- .3 Contact rating of up to 22A between 125V and 480V.
- .4 Fluid-filled capillary sensing bulb with 1800mm length, suitable for sensing remotely.

Part 3 Execution

3.1 INSTALLATION

- .1 Install heating cables in accordance with manufacturer's instructions. Coordinate installation with pipe insulation application.
- .2 Distribute cable on pipe or well as indicated on drawings. Ensure that heating cables do not touch or cross each other at any point. Run only cold leads in conduit and ensure sensing bulb does not touch cable. Coordinate cable installation with insulation application. Loop additional cable at fittings, valves and flanges.
- .3 Make power and control connections.
- .4 All self-regulating and constant wattage heat trace is to be supplied from a GFI-protected powersource
- .5 Ensure that aluminum tape is run throughout the length of all non-metallic piping and is installed between the heat tracing and the piping. Where purpose-specific heat trace channel is provided as part of the manufactured piping system, aluminum tape is not required for the trace.
- .6 Ensure that sensing bulbs are securely attached to pipe with aluminum tape between bulb and pipe, and between bulb and pipe insulation.
- .7 Install ambient sensing controllers on north facing surfaces to minimize direct sunlight.
- .8 Heat trace is not to enter any part of the building envelope.
- .9 Only mineral insulated cable approved for submersion may be submerged in water. For other types of heating cables, ensure that no part of any heat trace is installed in an area where it is submerged in water.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 Common Work Results - Electrical.
- .2 Use 500V megger to test cables for continuity and insulation value and record readings before, during and after installation. Ensure that these conditions comply with the manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

Part 2 Product

2.1 EQUIPMENT

- .1 Provide new artificial grounding electrode system as indicated on drawings.
- .2 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.
- .3 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
- .4 Rod electrodes: copper clad steel 19 mm diameter by 3 m long. To be Weaver, Thomas & Betts, Erico, Talley or approved.
- .5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .6 Insulated grounding conductors: green, stranded copper type RW90-XLPE.
- .7 Grounding connectors: Hydraulic compression tool applied connectors or exothermic welding process connector or listed mechanical type connectors. Manufacturer: Burndy Hyground Compression System, Erico/Cadweld, Amp Ampact Grounding System or approved.
- .8 Pipe grounding clamp: Mechanical ground connector with cable parallel or perpendicular to pipe. Burndy GAR series, O-Z Godney, Thomas & Betts or approved.
- .9 Telecommunications Ground bus: 6 mm thick by 50 mm wide by 300 mm long copper ground bar complete with insulated supports, fastenings, connectors, etc. To be Erico, Thomas & Betts or equal.
- .10 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 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install ground rods and ground rod inspection boxes as recommended by the manufacturer. Install box level and flush to the pavement.

- .3 Install equipment grounding conductor, code sized minimum unless noted otherwise on drawings, in all metallic raceway system.
- .4 Install connectors in accordance with manufacturer's instructions.
- .5 Protect exposed grounding conductors from mechanical injury.
- .6 Use bare copper conductor for underground and partially underground, and insulated copper conductor for above ground connections.
- .7 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process, permanent mechanical connectors or irreversible wrought copper compression connectors to ANSI/IEEE 837.
- .8 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .9 Soldered joints not permitted.
- .10 Install bonding wire for flexible conduit, connected at one ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .11 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .12 Install separate ground conductor to outdoor lighting standards.
- .13 Install grounding resistance bank as indicated.
- .14 Connect building structural steel and metal siding to ground by welding copper to steel.
- .15 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .16 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .3 Install rod electrodes and make grounding connections as indicated.
- .4 Bond separate, multiple electrodes together.
- .5 Use copper conductors for connections to electrodes; size as indicated on drawings.
- .6 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list:
 - .1 Service equipment;
 - .2 Transformers;
 - .3 Switchgear;
 - .4 Raceway systems including cable tray;
 - .5 Frames of motors;
 - .6 Motor control centers;

- .7 Process Piping
- .8 Starters;
- .9 Control panels;
- .10 Building steel work;
- .11 Generators;
- .12 Distribution panels;
- .13 Outdoor lighting and parking receptacles;
- .14 Motor shaft grounding devices where provided. See motor specifications in Division 25.
- .15 Low voltage and telecommunications systems including but not limited to cabinets, racks, patch panels, electronics, device boxes, etc..

3.4 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room. Size as required for the service grounding.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual stranded copper connections. Conductor size as indicated on drawings.

3.5 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
 - .1 Install telecommunications ground bus (TGB) in an appropriate location, 350 mm above the finished floor on the backboard in each one of the Telecommunications/LAN closet and equipment room.
 - .2 Connect busbars to each other and back to the main service ground connection point by green-insulated #2 AWG RW90-XLPE copper conductor.
 - .3 Telephone PBX: 1 #6 AWG RW90-XLPE to telecommunications ground bus (TGB).
 - .4 Telephone service conduit: 1 #6 AWG RW90-XLPE at each end to main service ground connection point and TGB respectively.
 - .5 Structured wiring equipment: 1 #6 AWG RW90-XLPE to TGB for each.
 - .6 Structured wiring raceways to be bonded together using #6 AWG RW90-XLPE for every two adjacent piece. The system shall be bonded to TGB using 1 #6 AWG RW90-XLPE conductor.
 - .7 Fire alarm and detection 1 #6 AWG RW90-XLPE in 12 mm conduit to nearest ground bus.
 - .8 Television distribution system to be bonded same as telephone.
 - .9 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .10 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results -

- Electrical..
- .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.
 - .4 Disconnect ground fault indicator during tests.
 - .5 Obtain a copy of the latest service requirements from the utility company, perform tests listed therein as instructed, rectify issues and provide test reports.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 48 - Seismic Restraints for Electrical Systems.

Part 2 Product

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to hollow masonry, tile and plaster surfaces with nylon shields or lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts or rated epoxy anchors.
- .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 straps to secure surface conduits and cables 53 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 53 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 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except where allowed by applicable codes, with permission of other trade and approval of Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

- .14 Where screw fastenings are used on metal decking, screws are to be set in lower flutes only.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.

Part 2 Product

2.1 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Code gauge metal construction and/or cast corrosion-resistant type, conforming to Canadian Electrical Code, with screw on or hanged cover.
- .2 Construction: Welded steel construction with screw-on flat covers for surface mounting.
- .3 Covers: with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
 - .1 Screw-on flat covers for surface mounting.
 - .2 25mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

- .1 Cabinets: Code gauge metal prime coated, locking door, concealed flush hinges, flush lock and catch assembly.
- .2 Terminal Strips:
 - .1 Below 50 volts - screw terminal type, Armaco T12-2 or Cinch Series 500.
 - .2 Above 50 volts - 250 volt screw terminal type with barriers between each set of terminals with individual terminal points for each conductor.
- .3 Signage: number identify terminal strips with permanent numbers. Provide wiring diagram on inside of terminal cabinet door showing units and conductors connected to terminal cabinet.
- .4 Construction: welded aluminum hinged door, handle, latch and catch
- .5 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .6 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm G1S plywood backboard for surface mounting.

2.4 KIOSK ENCLOSURE

- .1 Weatherproof enclosure, NEMA 3R or equivalent. Slope roof away from doors. Roof of kiosk to overhang doors when in the closed position.
- .2 Three point locking hinge, gasketed doors with flush lock and locking hasp.

- .3 Minimum 12GA Sheet Steel with minimum of 26mm of mineral-based, non-combustible insulation completely covering all interior surfaces and door interiors.
- .4 Removable lifting ears.
- .5 Stainless steel hinge, piano or bullet type. Hinge to be hidden when kiosk door closed.
- .6 Provide kiosk grounding stud suitable for 10mm ground cable. Provide grounding studs and braided copper grounding strap for each door, (minimum 7mm (1/4") grounding stud)
- .7 Provide kiosk steel back plane, with minimum 38mm (1.5") standoff studs.
- .8 Kiosk to be powder coated light grey colour.
- .9 Roll kiosk edges inward at base, minimum 76mm (3"), suitable for gasketing under kiosk to concrete base. Provide reinforced 19mm (3/4") anchoring holes for anchoring kiosk to concrete base.
- .10 Inner door pocket: sheet steel, suitable for 38mm (1.5") thick, letter size binder.
- .11 Enclosure Heater: As described in schedule on drawings.

2.5 ENCLOSURE

- .1 Enclosure: Indoor type sprinkler proof.

Part 3 Execution

3.1 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the 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 blocks as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes as per the requirements of the Canadian Electrical Code.

3.3 IDENTIFICATION

- .1 Provide equipment Identification in accordance with Section 26 05 00 - Common Work Results for Electrical
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.

Part 2 Product

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 for special devices.
- .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 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for luminaire outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.
- .5 Sectional boxes are not allowed.

2.3 BOXES FOR RIGID STEEL CONDUIT

- .1 Cast FS or FD aluminium ferrous boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle and exterior devices.
- .2 To be Crouse Hinds or approved equal.

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 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.5 BOXES FOR CORROSIVE ENVIRONMENTS

- .1 Typical of all corrosive environments as required by Section 22 of the CEC. Equipment in hazardous locations shall be in accordance with Section 18.
- .2 Epoxy coated galvanized steel boxes. Use only stainless steel fasteners suitable for the environment.

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 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

1.2 LOCATION OF CONDUIT

- .1 Drawings do not indicate all conduit runs. Those indicate are diagrammatic only. Determine best routing for conduit on site, ensuring requirements of this specification are met.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.

Part 2 Product

2.1 CONDUIT

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible steel with ultraviolet-protected outer PVC sheath and rated for installation at -20°C..
- .6 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3 liquid-tight flexible conduit.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" for 90 degrees bends for 35 mm and larger conduits.
- .3 EMT couplings and connectors to be dry type in type 1 environments, and watertight where installed outdoors, or as required on the drawings.

- 2.4 EXPANSION FITTINGS FOR RIGID CONDUIT**
- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 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 PULL CORD**
- .1 Minimum 6mm stranded nylon (polypropylene) pull rope, tensile strength 5 kN. Leave pull rope in any spare conduit exceeding 3 meters in length, or 90 degrees of bend.

- 2.6 THREAD LUBRICANT**
- .1 Make up all male conduit threads with thread lubricant prior to connection.

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 All conduit to be surface mounted or buried.
 - .3 Use rigid galvanized steel threaded conduit where transitioning from below grade to above splash pads at water wells. Extend conduit above splash pad as shown on drawings, but no less than what is required to install cast junction boxes.
 - .4 Use electrical metallic tubing (EMT) except in cast concrete.
 - .5 Use rigid pvc conduit underground.
 - .6 Use flexible metal conduit for connection to motors in dry areas.
 - .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
 - .8 Minimum conduit size for lighting and power circuits: 19 mm.
 - .9 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
 - .10 Mechanically bend steel conduit over 19 mm diameter.
 - .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight. Allow for minimum of 5 threads to be engaged.
 - .12 Install pull cord in empty conduits.
 - .13 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
 - .14 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. Channels to have 25% spare capacity.
- .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 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 35 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.
- .3 Seal both ends of conduit with sealant to prevent ingress and transmission of foreign material and moisture.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association, (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 CABLE PROTECTION

- .1 38 x 140 mm (thickness x width) planks pressure treated with clear, 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: 89 x 89 mm, 1.5 m long, pressure treated with clear, copper naphthenate 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.
- .3 Underground marker:
 - .1 Inert polyethylene plastic ribbon, 150 mm wide by 0.1 mm thick. Safety red for electric power distribution. Safety alert orange for telephone, signal, data and cable TV. Imprint over entire length of ribbon in permanent black letters, the system description selected from manufacturer standard legend, which most accurately describes the subgrade system. To be Allen Systems, Panduit Corp., or approved equal.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

- .1 After sand bed specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm 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 of surplus cable in each direction.
- .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; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .6 Cable separation: Maintain 1 m separation between primary power feeder cables and low tension systems in parallel and perpendicular crossings.
- .7 Notwithstanding the typical underground cable and conduit installation detail shown on the drawings, for main feeders, after sand protective cover specified in Section 31

23 10 - Excavating, Trenching and Backfilling, is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks or concrete blocks as indicated to cover length of run.

- .8 Install continuous marker tape marking both sides of trenches wider than 600mm, and every 600mm therein.

3.2 CABLE INSTALLATION IN DUCTS

- .1 Clean and dry ducts prior to installing conductors.
- .2 Install cables as indicated in 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 multi-conductor 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.

3.3 MARKERS

- .1 Mark cable every 150 m along cable runs and changes in direction.
- .2 Mark underground splices where such splicing is specifically allowed.
- .3 Where markers are removed to permit installation of additional cables, reinstall markers.
- .4 Install cedar post type markers.
- .5 Lay concrete markers flat and centred over cable with top flush with finish grade.
- .6 Install underground marker as shown on drawings.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform tests using qualified personnel. Provide 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. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Perform test in accordance with manufacturer's instructions.
- .6 Pre-acceptance tests.
- .7 Acceptance Tests.
- .8 Submit test results showing location at which each test was made, circuit tested and result of each test. Include a copy of test reports in the O&M manuals.
- .9 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Scope of the work under this section is to provide professional design and build seismic restraints accordingly for electrical systems as indicated hereinafter, as well as site certification of such work.

1.2 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit product data in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Provide shop and placement drawings for all electrical equipment and equipment assemblies including runs of conduit/cable racks showing the methods of attachment to the particular structure for each piece of equipment and assembly and provide anchorage/attachment details.
- .3 Submit samples of materials required to complete the seismic restraint work for review if and when required.

1.3 DEFINITIONS

- .1 Post Disaster Buildings: buildings essential to provide services in the event of a disaster. In other words, buildings in which life safety and continued building operations are of equal concern. It is necessary that the building remain operational during or after a seismic event.
- .2 The Pleasant Camp Port of Entry Site has been determined to be a post disaster building as defined by the National Building Code of Canada.
- .3 SRS: Seismic Restraint System.

1.4 SYSTEMS

- .1 This section applies to the following systems:
 - .1 Switchboards and transformers.
 - .2 Luminaires.
 - .3 Conduit and cable banks.
 - .4 Motor Control Centers
 - .5 Emergency Generators

1.5 DESIGN OF RESTRAINTS

- .1 Detailed design of restraints is to be completed by a Professional Engineer specializing in design of SRS and who is registered to practice in the Province of British Columbia.

1.6 SITE CERTIFICATION

- .1 Site certification for systems described in article 1.4 is to be provided at no additional cost to the owner. Provide for site certification of installation by Professional Engineer specializing in design of SRS and who is registered to practice in the Province of British Columbia. For measures of cost savings, it is encouraged that the same seismic engineer that is used by the Division 23 contractor is to be shared with Division 26.

1.7 DESIGN AND INSTALLATION COORDINATION

- .1 Coordinate the design and installation of the seismic restraints for the following with architect:
 - .1 Luminaires installed in an all-around exposed fashion such as pendent mounted or the like, installed in public spaces, areas subject to general occupant view, and other areas to architect's discretion; and
 - .2 Other electrical equipment, devices and components installed in public spaces, areas subject to general occupant view, and other areas to architect's discretion.

Part 2 Products

2.1 MATERIALS

- .1 Where provided, SRS components are to be provided from one manufacturer regularly engaged in the production of SRS components.
- .2 Security Bridles: Minimum #16 AWG stranded stainless steel aircraft cable.
- .3 Mechanical Anchors: Approved SRS anchors, minimum 13mm dia.
- .4 Threaded Anchors: Minimum Type ASTM A 325-00. Minimum 13mm diameter.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide seismic restraint and anchorage for all equipment and services as indicated.
- .2 Free-standing equipment shall be fastened to the basic structure using anchorage/ attachments to overcome seismic overturning forces.
- .3 Provide Seismic restraint for all cables and raceways exceeding 50 mm in any cross-sectional dimension and which are supported more than 300 mm vertically from the basic structure.
- .4 Provide slack cable restraint systems as follows:
 - .1 Connect slack cable restraints to suspended equipment in such a way that the axial projection of the wires passes through the centre of gravity of the equipment.
 - .2 Orient restraint wires on suspended equipment at approximately 90 degrees to each other (in plan) and tie back to the structure at an angle not exceeding 45 degrees to the horizontal.
 - .3 Select each anchor in the structure for a load equal to twice the weight of the equipment with the safety factor of 4.
 - .4 Install cables using appropriate grommets, shackles, thimbles, U-bolts and other hardware to ensure alignment of the restraints and to avoid bending the cables at connection points.
 - .5 Restraints shall be installed at least 50 mm clear of all other equipment and services.
 - .6 Adjust restraint cables such that they are not visibly slack, but such that the flexibility is approximately 35 mm under thumb pressure for a 1500 mm cable length (equivalent ratio for other cable lengths).
- .5 Provide transverse and axial restraints within 4.0 m of a vertical bend.
- .6 Trapeze hangers for cables and raceways shall be restrained utilizing minimum 10

mm diameter slack cable restraints, which shall be provided at maximum transverse spacing of 12.5 m and longitudinal restraints at 25 m maximum spacing, or as otherwise limited by anchor/slack cable performance. Adjacent spacing of restraints on a run shall vary by 10% to 30% to avoid coincident resonances.

- .7 Transverse bracing for one raceway section may also act as longitudinal bracing for the raceway connected perpendicular to it, provided the bracing is installed within 610 mm of the elbow or junction box. Branch runs shall not be used to restrain main runs.
- .8 All recessed lighting fixtures in mechanical grid ceilings (e.g. T-bar or suspended GWB) shall be restrained using at least 2 security bridles per fixture tied to the basic building structure. Attach security bridles at ends of each fixture using a further attachment to each corner of the fixture and in such a manner that the fixture cannot fall lower than 300 mm (12") beneath ceiling.
- .9 Surface-mounted lighting fixtures mounted on mechanical grid ceilings shall be attached to the ceiling system with positive clamping devices that completely surround the supporting members. Security bridles shall be attached between the clamping devices and the adjacent ceiling hanger or to the structure above in the same manner as described for recessed fixture supports.
- .10 Pendant-hung lighting fixtures supported from their outlet boxes shall be provided with a security bridle from the outlet box to an adjacent ceiling hanger or to the structure above in the same manner as described for recessed fixture supports.
- .11 Electrical outlet boxes flush mounted in mechanical grid ceilings shall be anchored to the ceiling grid.

3.2 INSPECTION AND CERTIFICATION

- .1 Do not cover any seismic restraint systems until reviewed by the SRS Engineer and the representative of the local authority having jurisdiction.
- .2 Site certification shall be complete prior to request for substantial completion review. Provide a copy of the certificate attached to the request for substantial completion review.
- .3 Include a copy of site certification in O&M manuals.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 NETA ATS-2013 - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

1.2 SCOPE

- .1 Provide a coordination/protective system study and a short circuit study of all equipment specified herein and submit for review.
- .2 Contact power utility company and obtain all necessary information to carry out this work.
- .3 Include the following:
 - .1 Primary and 208 V cable thermal damage curves;
 - .2 208 V circuit breaker overcurrent, overload and ground fault devices;
 - .3 120/208V panel boards, Main Distribution Boards, Motor Control Centres and connecting feeder cables;
 - .4 Any additional data necessary for successful completion of the coordination and short circuit study.
- .4 Data shall clearly state the operating time in cycles of each breaker and indicate whether the time current curves for relays are inclusive of breaker tripping time or otherwise.
- .5 Prepare a summation chart showing all ratings and settings with easy reference to the appropriate curve.
- .6 Symmetrical and asymmetrical fault current calculations shall be submitted to verify the correct choice of the protective elements of the system.
- .7 Perform arc flash studies, determine ratings available at each piece of electrical equipment and the Arc Thermal Performance Value (ATPV), as well as the Personal Protective Equipment (PPE) required for electrical work on such equipment.
- .8 Prepare the systems single line diagram on which the resultant short circuit values, device number and ratings are shown.

1.3 QUALIFICATIONS

- .1 This study should preferably be performed by the manufacturer of the power distribution equipment.
- .2 This study shall be performed by and bear the stamp of a Professional Engineer registered to practice in the Province of British Columbia and experienced in performing same studies.
- .3 The study shall be based on the actual project information obtained from the contractor by the Professional Engineer performing the study. Assumptions, estimations and the like are not acceptable.
- .4 The study shall be free of qualifications, disclaimers and the like whatsoever, which may otherwise render the study unreliable.
- .5 This study will be relied upon by all parties involved.

1.4 SUBMITTALS

- .1 Submit the complete study for review prior to carrying out calibration and verification and prior to submitting shop drawings for related electrical equipment.

- .2 The review of the study by Consultant will be limited to issues related to completeness of the study in compliance with contract requirements and will not include technical review of the study's accuracy and competency.
- .3 Responsibility for the technical accuracy and competency of the study rests fully and solely with the Professional Engineer stamping the study.
- .4 It is the responsibility of the Professional Engineer to timely request and obtain all the necessary information from the power utility company providing electrical service to the project.
- .5 It is the responsibility of the Professional Engineer to timely request and obtain all the necessary information from the manufacturers of the switchgear and other electrical equipment for a complete and accurate study.
- .6 It is the responsibility of the Professional Engineer to timely request and obtain all the necessary information from the contractor for a complete and accurate study.

1.5 TRIPPING DEVICES

- .1 Relay styles, Ct ratios and fuse sizes have been selected on a preliminary basis for design purposes.

1.6 PROVISIONS

- .1 Provide the Professional Engineer performing the study with all relevant data for the actual locations, actual feeder lengths and sizes, actual equipment used and the like whatsoever, as required by Professional Engineer for the study.

Part 2 Products

2.1 NOT USED

- .1 Not Used

Part 3 Execution

3.1 IMPLEMENTATION

- .1 Calibrate and verify the following equipment items supplied under this contract:
 - .1 208 V Switchboards and Panelboards; and
 - .2 208 V Enclosed circuit breakers, fused switches, starters and controllers;
- .2 The calibration and verification shall be carried out by the switchboard manufacturer in the field after installation and connection of equipment, but prior to being energized in the presence of the Departmental Representative. Include a copy of certificate of such calibration, verification and adjustment in the O&M manuals.

3.2 SUBMITTALS

- .1 Submit details of all test procedures and instruments, together with the technician's names, to the Engineer, prior to proceeding.
- .2 Submit a written verification report after installation is completed to reflect as built conditions.

3.3 QUALIFICATIONS

- .1 Work shall be performed by a firm specializing in and with relevant experience in testing 208V switchgear and protective relaying.

- .2 This firm shall also perform the final checkout and testing of the equipment specified in this Section.

3.4 CALIBRATION & VERIFICATION

- .1 The calibration shall be carried out in the following stages:
 - .1 208V Main distribution Panelboard;
 - .2 208V Subdistribution and Branch Circuit panelboards;
 - .3 208V enclosed breakers and fused switches, starters and controllers; and
 - .4 208V MCC's and individual motor starters and VFD's.
- .2 Advise three business days in advance when each stage is ready for the calibration and verification and:
 - .1 Ensure all equipment is installed, connected and cleaned inside and out.
 - .2 The electrical rooms are cleaned and are adequately illuminated and heated.
 - .3 Provide 120V convenience receptacles
 - .4 Provide one qualified electrician to assist in the calibration and verification.
 - .5 Provide all other facilities, equipment and personnel as normally required to assist in the calibration and verification.
- .3 For each circuit breaker, calibrate all protective relays and overcurrent device time and instantaneous trips in accordance with requirements of the protected equipment and overall coordination scheme. Field set each relay according to the recommended settings.
- .4 Verify all transformer ratios, insulation values, fuse sizes, C.T. and P.T. ratios, etc. and certify that the installation is in accordance with the requirements of the manufacturer and the Coordination/Short Circuit Study. Submit a written report on this verification to the Engineer.
- .5 Carry out the tests required for calibration and verification as specified in the other related sections.
- .6 Clean all relays with dry, dust and moisture free compressed air.

END OF SECTION

Part 1 General

1.1 ESPECIALLY RELATED SECTIONS

- .1 Section 01 91 00 - Commissioning.
- .2 Section 23 08 00 - Mechanical Commissioning.
- .3 Section 25 01 11 - Start-up and Check-out.
- .4 Equipment startup and testing procedures are specified in the respective Sections.

1.2 INTENT

- .1 This Section specifies electrical requirements relating to the commissioning of components, equipment and systems specified within Division 26, 27, 28, 33 and 34.
- .2 Responsibility for the satisfactory completion of the system and the subsequent demonstration of systems to the requirements of the commissioning rests with the Division 26 sub-contractor. The Division 26 sub-contractor is to provide and pay for any specialist supervision, inspection and testing as required to complete the work described with the exception of the other members of the Commissioning Team.
- .3 The Electrical Commissioning process consists of:
 - .1 Review by the Commissioning Agent of all contractor submittals.
 - .2 Completion and acceptance of Pre-Functional Check sheets (PC) for the specified Electrical Equipment.
 - .3 Completion and acceptance of Functional Performance Tests (FPT) for the specified building systems. FPT will be directed by the Commissioning Agent and witnessed by the Commissioning Team. The FPT tests will be performed by the Division 26 sub-contractor.
 - .4 Review by the Commissioning Agent of all training procedures and operations and maintenance manuals.
 - .5 Completion of a 10 month warranty performance review by the Commissioning Agent.
 - .6 Completion of a Systems Manual by the Commissioning Agent.
- .4 Except where otherwise specified, the Division 26 sub-contractor is to arrange and pay for the testing and related requirements specified in this and related Sections.
- .5 If test results do not conform with applicable requirements, repair, replace or adjust or balance components and systems. Repeat testing as necessary until acceptable results are achieved.
- .6 This Section is to be read in conjunction with related Sections which specify specific portions of electrical starting and testing work.

1.3 COMMISSIONING TEAM

- .1 The Commissioning Team consists of the following personnel:
- .2 Contractor Representatives:
 - .1 Commissioning Agent.
 - .2 General Contractor.
 - .3 Division 26 sub-contractor.
 - .4 Division 27 sub-contractor.
 - .5 Division 28 sub-contractor.
 - .6 Division 33 sub-contractor.

- .7 Division 34 sub-contractor.
- .3 Owner: Designated representatives of the Government of Canada.
- .4 Authorities having jurisdiction where applicable.

1.4 SITE REPORTING

- .1 Site hard copies of all Commissioning forms will be provided and maintained by the Commissioning Agent for use by the Commissioning group.
- .2 The Commissioning Agent and the Division 26 sub-contractor will be responsible for recording all data gathered on site on the hard copy forms as specified.

1.5 FINAL REPORT

- .1 The Commissioning Agent will be responsible for compiling the final report.
- .2 The Division 26 sub-contractor shall provide upon request within 14 days a completed single copy of any required test sheets, warranties, start up and systems commissioning sheets as requested by the Commissioning Agent for compiling within the final report.
- .3 Copies of the final report will be provided to all Commissioning Team members.

1.6 PROCESS

- .1 The commissioning process commenced during design and will proceed through construction and post construction to the following general process and schedule:
 - .1 Construction:
 - .1 Within 90 days of award of the contract a Commissioning kick-off [teleconference] meeting will be held.
 - .2 Submittal reviews will be completed by the Commissioning Agent to ensure conformance to the Owner's commissioning requirements.
 - .3 Throughout the course of construction the sub-contractors are to complete all specified contractor proving tests and submit the necessary documentation. The Commissioning Agent will witness this testing at their discretion.
 - .4 Throughout the course of construction the sub-contractors are to complete the Pre-Functional Checksheets for each specified system/ equipment for which they are responsible.
 - .5 A minimum 120 days prior to the start of the Functional Performance Tests a site testing schedule will be developed by the Contractor in cooperation with the Commissioning Team. At this time copies of all Functional Performance Test Checksheets will be made available.
 - .6 During the last three months of the construction process there will be a monthly commissioning meeting to review the construction schedule and commissioning requirements.
 - .7 Within 30 days of the start of the startup, check-out and commissioning verification process a dedicated Test Planning and Scheduling meeting will be completed to coordinate the commissioning verification process.
 - .8 Upon completion of the construction the design Consultant will identify that the building startup and checkout is completed and the systems are suitable for verification.

- .2 Commissioning Verification
 - .1 Verification of testing required by the Division 26 documents by the Commissioning Team.
 - .2 Sample review and acceptance by the Commissioning Team of the Pre-Functional Check sheets (PC) for the specified Electrical Equipment completed by the Division 26 contractor.
 - .3 Completion and acceptance of all Functional Performance Tests (FPT) for the specified building systems. The FPT testing will be directed by the Commissioning Agent and witnessed by the Commissioning Team. The FPT testing will be performed by the Division 26 contractor.
 - .4 Additional commissioning meetings as specified.
- .3 Warranty: Commissioning activities for warranty period are detailed in the Commissioning Plan.
- .2 Contractor's representatives to be present for all Commissioning of systems that falls within the scope of their work.
- .3 Unless otherwise specified in writing by the Contractor all testing and related requirements specified herein will be performed prior to the issue of the Substantial Performance Certificate.

1.7 PRE-COMMISSIONING

- .1 All startups, balancing and adjustment as specified in Divisions 01, 26, 27, 28, 33 and 34 are to be completed prior to commencement of the Functional Performance Tests (FPT).

1.8 COORDINATION

- .1 It is the responsibility of the Division 26 sub-contractor to coordinate all sub-trades, manufacturers, suppliers and other specialists as required to ensure all phases of work shall be properly organized prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.
- .2 Where any components or systems require testing prior to starting, ensure that such work has been completed and approved prior to starting of these components and systems.

1.9 SEASONAL CONSTRAINTS

- .1 Notwithstanding all-inclusive requirements specified in this Section an additional separate cycle of Commissioning may be necessitated at a later time for components and systems whose full operation is dependent on seasonal conditions.
- .2 The Division 26 sub-contractor's responsibilities with respect to such Commissioning activities will be the same as all activities specified in this Section.

1.10 COMMISSIONING MEETINGS

- .1 Provide the appropriate representation at the scheduled commissioning meetings as follows:
 - .1 Pre-commissioning kick-off meeting.
 - .2 FPT startup meeting.
 - .3 Commissioning wrap-up meeting.

- .2 With the exception of the pre commissioning kick off meeting which will be by teleconference all other meetings will be held at the site offices of the General Contractor.

1.11 PRESIDING AUTHORITIES

- .1 Procedures defined in this section may duplicate verification conducted by Authorities having jurisdiction. To facilitate expedient turnover of building, arrange for authorities to witness procedures in a manner that avoids unnecessary duplication of tests.
- .2 Obtain certificates of approval, acceptance and comply with rules and regulation of Authorities having jurisdiction. Provide originals of all certificates to the Consultant, and include a copy in O&M manuals.

1.12 CORRECTION OF DEFICIENCIES

- .1 Correct all contract deficiencies found during Commissioning.

1.13 COMPLIANCE

- .1 Failure to follow the specific instructions defined herein pertaining to correct starting procedures may result in re-evaluation of components by independent testing agency selected by the Commissioning Agent at the Contractor's expense. Should results reveal components have not been started in accordance with specified requirements, components may be rejected. If rejected, remove components from site and replace. Replacement components shall also be subject to full starting procedures, using same procedures specified on the originally installed components.

1.14 WITNESSING OF CONTRACTOR PROVING TESTS

- .1 The Commissioning Agent may witness selected Contractor starting, testing, adjusting, balancing and cleaning procedures.
- .2 Advise the Commissioning Agent in advance that starting, testing, adjusting, balancing or cleaning processes are ready to commence. Consult with the Commissioning Agent to determine which procedures he may elect to witness. Provide advanced notice prior to commencement of each procedure or series of procedures to allow the Commissioning Agent to arrange for witnessing of tests as required.
- .3 To contractor to submit to the Commissioning Agent all testing, startup, adjusting, balancing and cleaning reports to the Commissioning Agent on successful review by the Departmental Representative.

1.15 ADDITIONAL TESTING CONDUCTED BY COMMISSIONING AGENT

- .1 The Commissioning Agent may select and conduct at random: components, systems and/or integrated systems to be re-tested in addition to the specified tests.
- .2 Testing of any component, system, or integrated system by the Commissioning Agent does not reduce the Division 26 sub-contractor's obligations for complete testing and start-up of systems as specified.
- .3 The Commissioning Agent will be responsible for the direct costs of any Commissioning Agent testing excluding the Division 26 sub-contractor's support.
- .4 The Division 26 sub-contractor will provide, without cost, support for these tests, including:

- .1 Qualified personnel to operate the appropriate components, systems and/or integrated systems.
- .2 Making all test equipment and instrumentation available to the Commissioning Agent.
- .5 The Division 26 sub-contractor can choose to witness any testing conducted by the Commissioning Agent.
- .6 Should any component or system fail under additional testing completed by Commissioning Agent the Division 26 sub-contractor will correct the deficiency and retest to the satisfaction of the Commissioning Agent at the Contractor's expense.

1.16 SPECIALIZED AGENCIES AND TESTING LABORATORIES

- .1 All reports generated by special testing agencies or testing laboratories shall be submitted by the Division 26 sub-contractor to the Commissioning Agent.
- .2 All agencies and testing laboratories shall be pre-approved by the Consultant with acceptable facilities and qualifications.
- .3 Include a copy of all such reports in O&M manuals.

Part 2 Products

2.1 TESTING INSTRUMENTS

- .1 Provide two-way radios, ladders, tools, instruments and other equipment as required to complete the program and as outlined in this specification.
- .2 Provide all safety equipment required for personnel involved in the starting, testing, adjusting and balancing program.
- .3 Use instruments supplied or calibrated by approved laboratory or manufacturer. Show the Commissioning Agent the current calibration certificate for each instrument to be used. Provide a copy of the calibration certificates with test reports.

Part 3 Execution

3.1 GENERAL

- .1 All Division 26 sub-contractor startups, balancing and adjustment to be completed prior to commencement of Functional Performance Tests including the following:
 - .1 Fire alarm verification;
 - .2 Megger testing of feeder cables;
 - .3 Operational testing of all components in power distribution system;
 - .4 Operation of lighting control system;
 - .5 VFD programming and operation tests;
 - .6 Motor starter operations;
 - .7 Testing of emergency lighting (battery-type);
 - .8 Generator and transfer switch set-up and operational testing;
 - .9 Structured wiring testing.

3.2 PRE-FUNCTIONAL CHECKLISTS (PC's)

- .1 Pre-Functional Checklists are the process to ensure the specified equipment is installed to the contract requirements. To complete this work a database of the checklists is completed by the Commissioning Agent. The Division 26 sub-contractor

shall then complete the PC's during the course of construction. When commissioning commences the Commissioning Team will verify the validity of selected sample PC's prior to commencing any performance tests. This process ensures that the equipment and systems are correctly installed prior to actually testing their operation.

- .2 Specifically the PC process shall follow these steps:
 - .1 The Commissioning Agent will complete the PC forms using an approved data base and hard copies will be provided to the Division 26 sub-contractor at the commissioning kick-off meeting.
 - .2 Where the contractor identifies missing PC's they are to advise the Commissioning Agent in writing. The Commissioning Agent provide the missing verification forms within 21 days.
 - .3 During the course of construction the Division 26 sub-contractor shall complete the Contractor portion of the PC forms.
 - .4 Minimum 14 days prior to commencing any performance tests the Division 26 subcontractor shall submit the completed hard copies of the forms for review by the Commissioning Agent. The Commissioning Agent will advise the Division 26 subcontractor of any missing information which the Division 26 sub-contractor shall rectify in a timely manner. It is recommended, however, that the Contractor prepare the PC's during the course of construction and submit them as they are completed during site review meetings.
 - .5 Upon receipt and acceptance off all PC's and when the design Consultants advise that the buildings are ready for Commissioning the Commissioning Team under the direction of the Commissioning Agent shall verify all or a selected portion there of for the completed PC's.
 - .6 Any deficiencies in the PC's shall be corrected in a timely manner by the Division 26 subcontractor.
- .3 Systems and equipment that will require PC's include:
 - .1 MDB;
 - .2 CDPs;
 - .3 Each individual branch circuit panelboard;
 - .4 Generator;
 - .5 Transfer switch;
 - .6 Emergency Lighting;
 - .7 Variable frequency drives;
- .4 Samples:
 - .1 A sample of a typical PC is attached for reference as being indicative of the requirements for all associated systems and equipment listed herein.

3.3 FUNCTIONAL PERFORMANCE TESTS (FPT's)

- .1 Functional performance tests (FPT's) are the process to ensure the systems operate to the contract requirements. To complete this work real time 100% point testing of all systems is completed by the Division 26 sub-contractor under the direction and witness of the Commissioning Agent and Team.
- .2 Prior to the FPT's commencing all Division 26 sub-contractor's and manufacturers startup and proving tests specified elsewhere are to be completed and approved.

- .3 Prior to the FPT's commencing all PC's are to be completed and approved.
- .4 FPT's shall be first conducted by the Division 26 sub-contractor independent of the Commissioning Team and then re-conducted and witnessed by the Commissioning Team based on the mutually agreed schedule developed by the Commissioning Agent as indicated elsewhere in the specifications.
- .5 The FPT forms will be generated by the Commissioning Agent from an approved data base and provided to the Division 26 sub-contractor a minimum 30 days prior to commencing the functional performance testing.
 - .1 Where the Division 26 sub-contractor identifies missing FPT forms they are to advise the Commissioning Agent in writing. The Commissioning Agent will provide the missing verification forms within 14 days.
- .6 FP tests are to be completed for each system as indicated in the following verification form list:
 - .1 CDP's;
 - .2 EDP's;
 - .3 All branch circuit panelboard;
 - .4 MCC's;
 - .5 Generator;
 - .6 Transfer switch;
 - .7 Emergency Lighting;
 - .8 Low voltage lighting controls;
 - .9 Variable frequency drives;
 - .10 Parking receptacle controller;

3.4 BUILDING OPERATIONAL SEMINAR

- .1 Subsequent to the substantial completion and as a component of the commissioning, a representative of the design Consultant or the Commissioning Agent will provide a 4-hour seminar on the "Building Operation" to the operating and maintenance personnel describing the intended operation of the building electrical systems. Provide one senior tradesperson familiar with the complete building electrical systems to assist in this training session as specified in Section 26 05 01 - Common Work Results - Electrical.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Service equipment and installation.

1.2 REFERENCES

- .1 CSA C83 Communication and Power Line Hardware.

1.3 CO-ORDINATION WITH POWER SUPPLY AUTHORITY

- .1 Co-ordinate and meet requirements of power supply authority.
- .2 Ensure availability of power when required.
- .3 Obtain new service application forms, assist the Departmental Representative with completing forms, deliver the completed forms to the utility company and follow up to conclusion.
- .4 Service costs levied by the utility companies are to be paid by the owner.
- .5 Obtain a copy of the most recent Customer Service Requirements and provide, install, test and report accordingly. Where the contract documents include more strict requirements, proceed with additional and more strict requirements.

Part 2 Product

2.1 EQUIPMENT

- .1 Service entrance board to Section 26 24 02.
- .2 Material:
 - .1 Underground service:
 - .1 Service Raceway: Schedule 40 PVC with Schedule 80 PVC or galvanized rigid steel bends.
 - .2 Electrical metallic tubing, necessary fittings: to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
 - .3 Service conductors from utility connection point: to Section 26 05 21 - Wires and Cables 0-1000 V, copper, type RW90 XLPE, size and number of conductors as indicated.
 - .3 Meter socket and test switch enclosure: to approval of supply authority thirteen (13) jaw type with test switch. Locate meter in EEMAC 3 enclosure with hinged, gasketed door and provision for padlocking.
 - .4 Coordinate with the utility company for any recent updates to their standard requirements, prior to bid.
 - .5 Coordinate with the utility company for any recent updates to their standard requirements, prior to ordering material.

Part 3 Execution

3.1 INSTALLATION

- .1 Install service equipment.
- .2 Install service lateral conductors allowing adequate conductor length for connection to service equipment.
- .3 Allow adequate conductor length for connection to supply by power supply

- authority.
- .4 Connect to incoming service.
- .5 Connect to outgoing load circuits.
- .6 Install ground fault equipment.
- .7 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.
- .8 Make provision for power supply authority's metering.
- .9 For Underground Service:
 - .1 Excavate the service lateral trench and backfill per specifications, as required by the power company and to the satisfaction of the local Authority Having Jurisdiction.
 - .2 Provide concrete pad and vault for the utility transformer per the utility company specifications.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform additional tests if required by authority having jurisdiction.
- .3 Obtain a copy of the utility company latest Customer Service Requirements and perform all test required by the utility company accordingly.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for service entrance board.

1.2 REFERENCES

- .1 CAN/CSA-C22.2 No.31, Switchgear Assemblies.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Submit shop drawings for this section after the study specified in Section 26 05 73 - Overcurrent Protective Device Coordination Study/Calibration received favorable review. Submittals prior to this will be rejected as insufficient information for review.
- .3 Indicate on shop 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.
- .4 Include time-current characteristic curves for circuit breakers and fuses.
- .5 Provide fully rated service entrance board assembly, including circuit breakers for the maximum available fault current as indicated on drawings.
- .6 Integrated TVSS:
 - .1 Evidence of compliance to safety certifications as per CSA must be submitted as requested.
 - .2 Evidence of unit performance as detailed in the product specifications.

1.4 TRAINING

- .1 Conduct training program for designated building maintainer to allow authorized personnel to understand and exercise all aspects of system operation. Training to consist of demonstration of disconnects, including panel and circuit breakers, for controlling power supply throughout the building for safety reasons. Training is not to consist of physical connection, disconnection, tampering, or any such activity that would normally be the sole responsibility of a certified journeyman electrician.
- .2 Training program to be of 2-hour duration. Training period schedule to be established by the Contractor reviewed and approved by the Departmental Representative. Training period to take place after building substantial completion and prior to building occupancy.

1.5 QUALITY ASSURANCE

- .1 Submit copies of certified test results in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for service entrance board for incorporation into manual specified in Section 01 78 30 - Closeout Submittals.

- .2 Submit copies of maintenance data for complete assembly including components.

Part 2 Product

2.1 SERVICE ENTRANCE BOARD

- .1 Service Entrance Board: to CAN/CSA-C22.2 No.31.
- .2 Rating: 120/208 V, three phase, four wire, 600 A, short circuit current as indicated on the drawings in kA (rms symmetrical).
- .3 Cubicles: 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 CT section to be 760 mm x 910 mm x 300 mm deep, unless larger dimension is required by the local utility company. Provide 35 mm internal wire way from metering section to C.T. section.
- .7 Barriered C.T. Section to be suitable for utility requirements. Provide mounting facilities for supply authorities meter.
- .8 CDP section to consist of an assembly of 3 pole moulded case automatic air circuit breakers with interrupting capacity of not less than the KAIC (rms symmetrical) indicated on drawings . Frame size and trip ratings as shown on drawings. Bus capacity and main breaker amperage to be as indicated on drawings. Where space only is called for, provide all mounting hardware including but not limited to busbar drillings, mounting brackets, filler pieces, etc. to facilitate the field installation of future breakers.
- .9 Distribution section.
- .10 Hinged access panels with captive knurled thumb screws.
- .11 Bus bars and main connections: 99.3% copper.
- .12 Bus from load terminals of main breaker to metering section and bus from metering section to lugs of distribution section.
- .13 Identify phases with colour coding.
- .14 Barriered section for housing transfer switch.
- .15 Provide fully rated circuit breakers throughout the system.
- .16 Enclosure: Indoor type sprinkler proof.
- .17 Prior to bid and again prior to submitting shop drawings, ensure that the suggested panelboard fits in the location shown on drawings. Inform Departmental Representative immediately if the specified gear would not fit.

2.2 MOULDED CASE CIRCUIT BREAKERS

- .1 Sized as indicated on drawings. To have electronic trip for the main and thermal magnetic trip for the distribution breakers. Size as indicated on drawing.
- .2 Minimum interrupting capacity to meet or exceed the interrupting capacity indicated on drawings
- .3 Each breaker complete with locking hasp, suitable for locking in the closed (on) or open (off) position.

2.3 GROUNDING

- .1 Copper ground bus extending full width of cubicles and located at bottom.

- .2 Lugs at each end for the grounding cable size indicated on drawings.

2.4 INTEGRATED TVSS GENERAL FEATURES

- .1 The devices shall be suited for operation in 120/208 VAC as shown on the drawings, 3 pole, 4 wire electrical configuration and effectively provide TVSS filtering.
- .2 The integrated filtering panel shall be of fully integrated design utilizing only the DBC methodology (Direct Busbar Coupling). The DBC method shall eliminate lead length impedance factors and provide optimum distribution system protection.
- .3 Suppression/Filter System Connections. No plug-in component modules, quick disconnect terminals or printed circuit boards shall be used in surge current-carrying paths.
- .4 Circuit construction must be fully tested to NEMA LS-1 to reflect full surge current withstand capabilities.
- .5 The unit shall have visual indicator lights for each phase of operation. The system shall continuously monitor the operating status of each phase of suppression protection. If the unit is in proper working order, the indicator light shall be illuminated green. If the unit performance is degraded, the lamp light colour shall change to red. These indicators must be visible without removal of the panel trim. In the event that the operation of the unit's suppression or filtering becomes impaired, a red flashing indicator light shall be illuminated. This lamp shall be visible from a distance of 20 meters.
- .6 Fuses: The TVSS/filter system shall utilize internal fuses rated with a minimum interrupting rating of 200,000 AIC.
- .7 Identification: The unit shall include manufacturer's nameplates and CSA approval on the exterior of the enclosure.
- .8 Warranty: The manufacturer shall provide a limited five year warranty on the TVSS filter. The warranty shall commence from date of shipment.
- .9 Testing: Testing of each unit shall include quality assurance checks, "Hi-Pot" test at two times rated voltage plus 1000 volts per UL requirements, and operational and calibration tests.
- .10 Noise filtering:
 - .1 The unit shall include a high frequency extended range tracking filter with an effective filtering bandwidth of 10 KHz to 50 MHz.
 - .2 Noise attenuation shall be a minimum of 50 DB at 100 KHz based on standard insertion loss data obtained utilizing the MIL STD-E220A, 50 ohm insertion loss methodology.
- .11 Modbus and Ethernet communication ports ready for plug and play.

2.5 CUSTOMER DIGITAL METERING

- .1 Provide customer digital metering with sensing point immediately after main service disconnect with the ability to sense and display the following parameters and RS232 or ethernet port to interface with a computer for data collection:
 - .1 Volts phase to phase, average;
 - .2 Volts line to neutral, average;
 - .3 Volts neutral to ground;
 - .4 Current per phase and average;

- .5 Neutral current;
- .6 Ground current;
- .7 Real power;
- .8 Reactive power;
- .9 Apparent power;
- .10 Energy consumption - real, reactive and apparent;
- .11 Power factor - displacement and apparent;
- .12 Frequency;
- .13 Demand - current, real power, reactive power and apparent power;
- .14 Total harmonic current distortion (%)
- .15 Total harmonic voltage distortion (%)
- .16 K-factor;
- .2 Specifications: Power requirements 10 Watts. Full scale accuracy, maintained from 3% to 250% of CT primary rating, for all voltages and currents as low as +/-0.5%, for Watts, Vars, VA, Watt-hours, Var-hours and VA-hours +/-1.0% for power factor +/-2.0%, frequency +/-0.1Hz and +/-1.0% for %THD. Overload withstand 15A, 635Vac continuous and 300Aac for 1 second.

2.6 FINISHES

- .1 Apply finishes in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Service entrance board exterior per Section 26 05 00 - Common Work Results for Electrical.
- .3 Supply 2 spray cans touch-up enamel.

2.7 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplates:
 - .1 White plate, black letters, size 4.
 - .2 Complete board labelled: "Indicating Service voltage, Consultant, Contractor and Gear"
 - .3 Main disconnect labelled: "Main Breaker".
 - .4 Branch disconnects labelled: with Size 4 labels.

2.8 SOURCE QUALITY CONTROL

- .1 Conduct equipment inspection at manufacturer's plant.
- .2 Provide manufacturer's inspection and test certificates.
- .3 Departmental Representative to witness final factory tests.
- .4 Notify Departmental Representative in writing 5 days in advance that service entrance board is ready for testing.
- .5 Submit test and inspection certificates to Departmental Representative for review. Include a copy in Operation & Maintenance manuals.
- .6 Include all costs associated with the above-indicated items [including the factory test witnessing] in the bid.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate service entrance board on the concrete housekeeping pad and fasten to wall and floor.
- .2 Connect main secondary service to line terminals of main breaker.
- .3 Connect load terminals of distribution breakers to feeders.
- .4 Check factory made connections for mechanical security and electrical continuity.
- .5 Run grounding conductor insulated green copper, size and quantity as indicated on drawings, from ground bus to building ground.
- .6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.
- .7 Ensure that C.E.C. requirement for non-combustible base is met.
- .8 Provide raceway and Cat 6 wiring between the utility meter and telecom backboard
- .9 Provide raceway and Cat 6 wiring between the TVSS unit and telecom backboard
- .10 Provide raceway and Cat 6 wiring between the customer meter unit and telecom backboard
- .11 Coordinate with the Owner and set up the IP address for the meter and TVSS. Set-up, program, test and verify the operation of both devices.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Submit shop drawings for this section after the study specified in section 26 05 73 - Overcurrent Protective Device Coordination Study/Calibration received favorable review. Submittals prior to this will be rejected as insufficient information for review.
- .3 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
- .4 Provide proof of compatible series rated combination groups for breakers and equipment, if used, with shop drawings.

1.4 PLANT ASSEMBLY

- .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.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for panelboards for incorporation into manual specified in Section 01 78 30 - Closeout Submittals.
- .2 Include data for each panelboard.
- .3 Include a copy of typewritten panel directories.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
- .2 250 V panelboards: bus and breakers rated for the maximum available fault current, as indicated on the drawings in kA (symmetrical) interrupting capacity, and resulted from the study specified in section 26 05 73, whichever is higher. 120/208 volt, 3 phase, 4 wire, solid neutral design with sequence style bussing and full size neutral of capacity 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 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Suitable for bolt-on breakers.

- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: air dried grey enamel for indoors and baked grey enamel for outdoors.
- .10 Provide fully rated circuit breakers throughout the system.
- .11 Branch circuit panelboards and all breakers within are to be part of a series rated combination group, which is compatible with upstream breakers and service entrance board.
- .12 Enclosure: Indoor type sprinkler proof.

2.2 CDP PANELBOARDS

- .1 Panelboards: product of one manufacturer.
- .2 Panelboard assembly including breakers to be fully rated for the maximum available fault current or the interrupting capacity (rms symmetrical) indicated on drawings.
- .3 250 V panelboards: bus and breakers rated for the maximum available fault current, as indicated on the drawings in kA (symmetrical) interrupting capacity, and resulted from the study specified in section 26 05 73, whichever is higher. 120/208 volt, 3 phase, 4 wire, solid neutral design with sequence style bussing and a minimum of full capacity neutral or larger as indicated on panel schedules.
- .4 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.
- .5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Mains and branches: suitable for bolt-on breakers.

2.3 BREAKERS

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
- .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 or as indicated. Turn over unused lock-on devices to Departmental Representative.
- .5 Lock-on devices for door supervisory, exit light, fire alarm and emergency lighting circuits.

2.4 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .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 typewritten panel directory showing number and location of each circuit. Provide three (3) typed panel directories, two of which in the plastic pouch attached to the inside of the panelboard door, and one in the O&M manuals.

Part 3 Execution

3.1 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 10 - Rough Carpentry. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Mount panelboard vertically with odd numbered breaker on the left and even numbered breakers on the right.
- .7 Wherever possible use pull boxes to collect home runs and larger conduits to complete the return to the branch circuits to avoid conduit congestion at the face of walls. Consider the CEC required derating factors and overcurrent protection when using collected homeruns.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Include time-current characteristic curves for breakers with ampacity of 200A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .3 Provide proof of compatible series rated combination groups for breakers and equipment, if used, with shop drawings.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Provide fully rated circuit breakers throughout the system.

2.2 THERMAL MAGNETIC BREAKERS [DESIGN A]

- .1 Except the main service breaker and breakers 400A and larger, for which electronic trip is specified, 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 Provide ground fault protection where shown on drawings.

2.3 MAGNETIC BREAKERS [DESIGN B]

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SOLID STATE TRIP BREAKERS [DESIGN D]

- .1 Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and instantaneous tripping for phase fault short circuit protection.
- .2 Provide ground fault protection where shown on drawings.

2.5 OPTIONAL FEATURES

- .1 Include: shunt trip breaker where indicated on the drawing.

2.6 ENCLOSURE

- .1 As indicated on drawings or specified.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.
- .2 Provide design D breaker for the main service and breakers 400A and larger, and design A for the rest unless design D is the only available option or the most cost effective technology.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Submit shop drawings for this section after the study specified in section 26 05 73 - Overcurrent Protective Device Coordination Study/Calibration received favorable review. Submittals prior to this will be rejected as insufficient information for review.

1.2 REFERENCES

- .1 CSA Group
 - .1 CAN/CSA-C22.2 No.4, Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
 - .2 CSA C22.2 No.39, Fuseholder Assemblies.

Part 2 Product

2.1 DISCONNECT SWITCHES

- .1 Fusible, or non-fusible, disconnect switch, as identified on drawings in CSA enclosure type 1 or 3 suitable for the location installed and sprinkler proof, unless indicated otherwise, size as indicated.
- .2 Provision for padlocking in on-off switch position by 3 locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated.26 28 14 - Fuses - Low Voltage
- .5 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Use class RK1, or class J fuses for general purpose loads.
- .7 Use class RK5 or class CC fuses for motor loads.
- .8 Use class CC fuses for control transformers.
- .9 Quick-make, quick-break action.
- .10 ON-OFF switch position indication on switch enclosure cover.
- .11 Horsepower rated for load interruption.
- .12 To include drip shields.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results - Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

- .2 Locate disconnect switch in site of the load.
- .3 Connect feeders.
- .4 Test and verify the operation of the switch.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for contactors for system voltages up to 600V.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.14, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.

Part 2 Product

2.1 CONTACTORS

- .1 Contactors: to CSA C22.2 No.14 and EEMAC No. 1CS..
- .2 Mechanically held or electrically held as indicated on drawings, controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
- .3 Breaker combination contactor as indicated.
- .4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .5 Enclosure: Indoor type sprinkler proof.
- .6 Include following options in cover:
 - .1 Red LED indicating lamp illuminated when contactor is closed. Provide Type B label.
 - .2 Selector or control switches as indicated on drawings.
 - .3 Stop-Start pushbutton.
 - .4 Hand-Off-Auto selector switch.
 - .5 On-Off selector switch.
- .7 Suitable for interruption of motor loads at rated current.
- .8 Electrically held units to be suitable for continuously energized coil operation.
- .9 Control transformer: Provide with primary and secondary voltages and the volt-ampere required for the load controlled, in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

- .1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Size 4 nameplate indicating name of load controlled.

Part 3 Execution

3.1 INSTALLATION

- .1 Install contactors and connect auxiliary control devices.

- .2 Identify contactors with nameplates or labels indicating panel and circuit number.
- .3 Test contactors in accordance with 26 05 00 - Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 International Electrotechnical Commission (IEC)
 - .1 IEC 947-4-1-2002, Part 4: Electromechanical contactors and motor-starters.
- .2 National Electrical Manufacturers Association (NEMA).

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples. Submit shop drawings for this section after the study specified in section 26 05 73 - Overcurrent Protective Device Coordination Study/ Calibration received favorable review. Submittals prior to this will be rejected as insufficient information for review.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .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 - Shop Drawings, Product Data, and Samples.
 - .1 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.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 30 - Closeout Submittals.
- .2 Include operation and maintenance data for each type and style of starter.
- .3 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.
- .4 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.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of pallets in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Provide manufacturer recommended spare parts for each different size and type of starter. Provide listed spare parts for each different size and type of starter:

Part 2 Product

2.1 MATERIALS

- .1 Starters: EEMAC E14-1.
 - .1 Half size starters not acceptable.
- .2 Starters: to IEC 947-4 with AC4 utilization category.
- .3 Enclosure: Indoor type sprinkler proof.

2.2 MANUAL MOTOR STARTERS

- .1 Single or Three phase manual motor starters of size, type, rating, and enclosure Type 1 unless otherwise indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One overload heaters, manual reset, trip indicating handle.
 - .3 Indicating light: standard red pilot light.
- .2 Accessories:
 - .1 Toggle switch: standard or key operated as indicated.
 - .2 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 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 Power and control terminals.
- .4 Wiring and schematic diagram inside starter enclosure in visible location.
- .5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .6 Hand-off-auto switch in enclosure door.
- .7 Motor overload devices could be either bi-metallic or electronic but must have time delay and self resetting feature.
- .8 Electronic overload relay:
 - .1 Self powered, non-thermal type with current sensing, 3:1 current range adjustment, phase unbalance and phase loss protection, harmonically insensitive, ambient insensitive with visible trip indication.
- .9 Overloads to be interchangeable without having to replace the entire starter.
- .10 Starters for motors 3HP and larger to have 0-5 minute adjustable start-up time delay.
- .11 Indicating lights: LED Type in Red cover.
- .12 Two sets of (NO) normally open auxiliary contacts in addition to the standard auxiliary holding contacts supplied with each contactor. One set of auxiliary contacts convertible to normally closed (NC).
- .2 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control circuit breaker, and provision for:
 - .1 Locking in "OFF" position with padlocks.
 - .2 Locking in "ON" position.
 - .3 Independent locking of enclosure door.
 - .4 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
 - .1 Selector switches: oil tight labeled as indicated.
- .4 Starter assembly to be fully rated for the maximum available fault current (rms symmetrical) at the location installed.
- .5 Enclosure: Type 1 or 3 suitable for the location shown on drawings.
- 2.4 CONTROL TRANSFORMER**
 - .1 Single phase, dry type, control transformer with primary voltage as indicated for the motor and secondary voltage as required to match the load, complete with secondary fuse, installed in with starter enclosure.
 - .2 Size control transformer for control circuit load plus 20% spare capacity.
- 2.5 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.
- 2.6 FINISHES**
 - .1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work

Results for Electrical.

2.7

EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results for Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 2 engraved as indicated.

Part 3

Execution

3.1

INSTALLATION

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload device elements installed.
- .3 Provide CEC required disconnect switch whether specifically shown on drawings or not. Provided disconnect switch in sight of each motor controller.

3.2

FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results for Electrical and per 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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Diesel engine driven stand-by generator set(s) complete with all accessories.
- .2 Enclosure: Indoor type sprinkler proof.

1.2 ESPECIALLY RELATED SECTION

- .1 Section 26 05 48 - Seismic Restraints for Electrical Systems.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)/American Petroleum Institute (API)
- .2 American National Standards Institute (ANSI)/National Electrical Manufacturers' Association (NEMA)
- .3 Canadian General Standards Board (CGSB)
- .4 International Organization for Standardization (ISO)
- .5 National Electrical Manufacturers Association (NEMA)
- .6 Underwriters' Laboratories of Canada (ULC)
- .7 CSA C282 - Emergency Electrical Power Supply for Buildings.

1.4 SYSTEM DESCRIPTION

- .1 Generating system consists of:
 - .1 Engine
 - .2 Alternator
 - .3 Control cubicle
 - .4 Automatic transfer switch
 - .5 Battery charger and battery
 - .6 Automatic engine room ventilation equipment
 - .7 Fuel supply system
 - .8 Engine exhaust system
 - .9 Mounting base
- .2 System designed to operate unattended as standby.
- .3 Generator Load Bank:
 - .1 Complete resistive load testing system including remote resistors, controls and all associated cabling and connections.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Include:
 - .1 Dimensioned drawing of set including engine, alternator, control cubicle, exhaust system, fuel system and accessories.
 - .2 Line diagram showing alternator, control cubicle, automatic transfer switch, voltage regulator, battery, battery charger, governor specifications.
 - .3 Diagram for automatic engine ventilation.
 - .4 Flow diagrams for:
 - .1 Fuel

- .2 Lubricating oil
- .3 Cooling air
- .5 Continuous full load output at 0.8 power factor lagging.
- .6 Type and make of governor.
- .7 Cooling air requirements in mn/s.
- .8 British standard or DIN rating of engine.
- .9 Set operation:
 - .1 Automatic starting, transfer to load, back to normal power and shut down.
 - .2 Manual starting
 - .3 Automatic shut down on over cranking, overspeed, high engine temperature, low lube oil pressure, short circuit and alternator overvoltage.
- .10 Proof of manufacturer confirmation that the unit meets or exceeds the performance requirements of article 2.14 while its outside dimensions fits in the allocated space as shown on drawings.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 01 78 30 - Closeout Submittals.
- .2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier.
- .3 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual operation of transfer switch, battery charger, fuel system and accessories to permit effective operation, maintenance and repair
- .4 Technical data:
 - .1 Illustrated parts lists with parts numbers.
 - .2 Schematic diagram of electrical controls.
 - .3 Flow diagrams for fuel, lube oil and cooling air.
 - .4 Certified 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 are required on site adjustment.

1.7 WARRANTY

- .1 Warranty for the generator unit and all accessories shall be extended to 60 months or 1500 operating hours, whichever occurs first.

Part 2 Products

2.1 DIESEL ENGINE

- .1 Diesel engine: to ISO 3046-1.
- .2 Naturally aspirated, synchronous speed 1800 r/min.
- .3 Capacity:
 - .1 Minimum total output of engine in hp (brake) to equal full output rating of genset British standard rating as defined in BS649 - 1958 expressed in hp

- (brake), plus the sum of the following:
 - .1 Power to drive cooling fan
 - .2 Power for all engine accessories.
 - .3 Power loss for site conditions
- .2 Site conditions; derate for:
 - .1 Ambient temp: 40°C
 - .2 Relative humidity: 60%
- .4 Engine: Engine: diesel 4 cycle, operating speed 1800 r/min, liquid cooled:
 - .1 Liquid cooled: radiator with engine driven fan and ethylene glycol anti-freeze non-sludging above -46°C.
 - .2 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start in 0°C room ambient.
 - .3 Thermal insulation heat blankets installed on engine manifold and turbo charger to minimize heat rejection to room and to protect operating personnel from hot surfaces and guards over moving parts. Locate guards so that normal maintenance inspections can be undertaken without their removal.
- .5 Cooling System:
 - .1 Set mounted radiator, suitable for connection/ducting to mechanical louvers and recirculating dampers.
- .6 Fuel system: solid injection, mechanical fuel transfer pump, fuel filters and air cleaner, fuel rack solenoid energized when engine running.
- .7 Governor: Mechanical with speed adjustment
 - .1 Speed regulation no load to full load 5% maximum
- .8 Starting system: 12 V DC motor, remote control, 12 V maintenance-free lead-acid storage battery of sufficient capacity to crank engine for 3 min at 0°C without using more than 25% battery capacity. Battery charger: constant voltage, solid state, two stage from trickle charge at standby to boost charge after use, regulation +/- 1% output for +/- 10% input variation. Capable of returning battery to full charge within 12 h after 10 cranking operations.
- .9 Vibration isolated engine instrument panel with:
 - .1 Lube oil pressure gauge.
 - .2 Coolant temperature gauge.
 - .3 Alarm indicators.
- .10 Emmission level: EPA (Environmental Protection Agency) Nonroad Tier 3 .
- .11 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.
- .12 Drip tray.

2.2 **ALTERNATOR**

- .1 Alternator: to ANSI/NEMA MG1-1.66, single bearing, revolving field, SAE housing, drip proof with amortisseur windings, direct driven sized for maximum motor starting.
- .2 Rating: 3 phase, 120/208 V, 4 wire WYE, 125 kW, 60Hz, at 0.8PF. Selected unit shall be capable of carrying the loads as described in section 2.14 - Performance, and have

dimensions equal or smaller than what is shown on the electrical drawings, to fit in the generator room while maintaining the code required clearances.

- .3 Output at 40 degrees C ambient:
 - .1 100% full load continuous.
 - .2 110% full load for 1 hour for prime power generator.
- .4 Electrically isolate neutral point from generator case.
- .5 Revolving field, brushless, single bearing.
- .6 Drip proof.
- .7 Amortisseur windings.
- .8 Synchronous type.
- .9 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.
- .10 Exciter: rotating brushless.
- .11 EEMAC class F insulation on windings.
- .12 Thermistors embedded in stator winding and connected to alternator control circuitry.
- .13 Voltage regulator: thyristor controlled rectifiers with phase controlled sensing circuit.
- .14 Alternator: capable of sustaining 300% rated current for period not less than 10s permitting selective tripping of down line protective devices when short circuit occurs.
- .15 Winding design to eliminate 3rd, 9th and 15th harmonics in line to neutral waveform. Telephone influence factor (TIF) of less than 50.

2.3 CONTROL PANEL

- .1 Totally enclosed, mounting base isolated from diesel generator.
- .2 To be microprocessor-based control system. Required control function include:
 - .1 Automatic starting, monitoring, and control functions for generator set.
 - .2 Provisions for local and remote monitoring of the generator set.
 - .3 Field programmable time delay for engine start (adjustable range, 0-5 minutes in 1 second increments), and time delay stop (adjustable range, 0-10 minutes in 1 second increments).
 - .4 All monitoring functions/events must be viewable on a digital display incorporating a data logging system with real time clock and calendar.
 - .5 Provide programmable cyclic cranking system with adjustable crank time, rest time, and number of cycles.
 - .6 To include an Idle Mode Control to start the generator set, and run it at an idle speed during warm-up.
 - .7 Overload and short circuit protection for alternator.
 - .8 Provisions for indication of four customer-specified alarm or shutdown conditions.
- .3 Control system to be an integrated generator set control system providing governing, voltage regulation, engine protection and operator interface functions. Major features to include:
 - .1 Integral protective relay providing a full range of alternator protection functions that are matched to the alternator provided.
 - .2 Battery monitoring and testing features and smart starting control system.

- .3 Three phase sensing, full wave rectified voltage regulation system, with a PWM output for stable operation with all load types.
- .4 Standard manufacturer's network interface, with appropriate com bus conversion to non-proprietary communications protocol (bacnet, modbus or similar). Selection of communication protocol to suit interconnected systems.
- .5 Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- .6 Prototype tested; CSA compliant.
- .7 PC-based service tool for detailed diagnostics.
- .8 Three (3) auxiliary relays
- .9 Remote annunciator
- .4 Operator/display panel:
 - .1 Off/manual/auto mode switch
 - .2 Manual run/stop switch
 - .3 Panel lamp test switch
 - .4 Emergency stop switch
 - .5 Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments
 - .6 LED lamps indicating generator set running, not in auto, common warning, common shutdown
 - .7 Five (5) configurable LED lamps
 - .8 Configured for English language
- .5 Engine protection:
 - .1 Over-speed shut down
 - .2 Low oil pressure warning and shut down
 - .3 High coolant temperature warning and shut down
 - .4 High oil temperature warning where high oil temperature sensor is a standard feature
 - .5 Low coolant level warning or shut down
 - .6 Low coolant temperature warning
 - .7 High and low battery voltage warning
 - .8 Weak battery warning
 - .9 Dead battery shut down
 - .10 Fail to start (over-crank) shut down
 - .11 Fail to crank shut down
 - .12 Redundant start disconnect
 - .13 Cranking lockout
 - .14 Sensor failure indication
- .6 Engine data:
 - .1 DC voltage
 - .2 Lube oil pressure
 - .3 Coolant temperature
 - .4 Lube oil temperature (some models)

- .5 Engine speed
- .7 AC protection:
 - .1 Over current and short-circuit shut down
 - .2 Over current warning
 - .3 Single and three-phase fault regulation
 - .4 Over and under voltage shut down
 - .5 Over and under frequency shut down
 - .6 Overload warning with alarm contact
 - .7 Reverse power and reverse Var shut down
 - .8 Excitation fault
- .8 Alternator data:
 - .1 Line-to-line and line-to-neutral AC volts
 - .2 Three-phase AC current
 - .3 Frequency
 - .4 Total and individual phase power factor, kW and kVA
- .9 Other data:
 - .1 Generator set model data
 - .2 Start attempts, starts, running hours
 - .3 kW hours (total and since reset)
 - .4 Fault history
 - .5 Load profile (hours less than 30% and hours more than 90% load)
 - .6 System data display
- .10 Governer:
 - .1 Digital electronic isochronous governor
 - .2 Temperature dynamic governing
 - .3 Smart idle speed mode
 - .4 Glow plug control where such control is included in the standard features for the unit
- .11 Voltage regulation:
 - .1 Digital PWM electronic voltage regulation
 - .2 Three phase line-to-neutral sensing
 - .3 Suitable for PMG or shunt excitation
 - .4 Single and three-phase fault regulation
 - .5 Configurable torque matching
- .12 Control functions
 - .1 Data logging on faults
 - .2 Fault simulation
 - .3 Time delay start and cool down
 - .4 Cycle cranking
 - .5 Network interfaces as listed above
 - .6 Four (4) configurable customer inputs
 - .7 Four (4) configurable customer outputs
 - .8 Configurable network inputs (8) and outputs (16)

- .9 Remote emergency stop. Install by the entrance to the generator room.
- .13 Lamp test button.
- .14 RS-232 and/or RS-485 communication protocols must be supported.

2.4 REMOTE ANNUNCIATOR

- .1 LED-type Remote annunciator to include common audible and individual illuminated alarm indicators for generator trouble (any alarm). To also include generator run light - no audible alarm. Provide alarm silence switch on remote annunciator. Power to be provided from generator battery source. To be supplied by generator manufacturer - not fabricated on site. To include Overcrank, Low Engine Temperature, High Engine Temperature, Low oil Pressure, Overspeed, Low Fuel, Control Switch not in Automatic Position, Low Voltage in Battery, Contacts for Local and remote common alarm, Audible alarm silencing switch, Low Coolant Level.
- .2 In order to communicate with the generating set control panel incorporate network communication module for the remote annunciator.

2.5 AUTOMATIC TRANSFER SWITCH

- .1 See section 26 36 23 - Automatic Transfer switches.

2.6 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 spring-type or rubber vibration isolators having an efficiency of 95% or higher and control console resiliently mounted.
- .3 Isolators are to have adjustable side snubbers approved and rated as seismic restraints, and adjustable for leveling.
- .4 Sound insulation pads for installation between isolators and concrete base.

2.7 EXHAUST SYSTEM

- .1 Heavy duty, critical grade horizontally mounted exhaust silencer with condensate drain, plug and flanged couplings.
- .2 Heavy duty flexible exhaust pipe with flanged couplings as required.
- .3 Fittings and accessories as required.
- .4 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.

2.8 FUEL SYSTEM

- .1 See Division 25 fuel supply.
- .2 Fuel storage tanks: to ANSI/API 650, ULC labeled.
- .3 Electronic fuel level gauge and vent alarm.
- .4 Visual sight glass fuel level gauge.
- .5 Black iron feed and return lines, with flexible terminations at engine.
- .6 Shut-off cock.
- .7 Renewable cartridge filter.
- .8 Fire valve.

- .9 Isolating valves on lines serving auxiliaries.
- .10 Low fuel level alarm for remote indication.
- .11 Provide fuel for testing and leave full tanks upon acceptance.

2.9 COOLING AIR SYSTEM

- .1 Engine ventilating system:
 - .1 Ventilation facilities to be reviewed by generator supplier prior to tender closing. Forward manufacturer comments to the Engineer at least 10 days prior to tender closing.
 - .2 Generator set suppliers to verify that cooling air volume provided under Division 23 is sufficient for the selected unit. Should additional cooling air be required to suit a particular product, contractor to make allowance for all modifications required in this contract.
 - .3 Supply all controls for standby generator ventilation from a branch circuit panelboard supplied by generator.
 - .4 A cooling system consisting of a direct mounted radiator and pusher fan, ie., the fan pushes the air through the radiator from the engine side. Filler caps shall be designed for pressure relief before removal. Hoses and connections shall be rated for maximum temperatures of 145 degrees C and pressure of 650 kPa. An engine driven water pump shall provide circulation of the coolant. The cooling system shall be filled with a solution of 50% permanent type ethylene glycol anti-freeze and 50% water. The cooling system shall be sized to maintain the coolant below the maximum operating temperature under conditions of; full load, 40 degrees C ambient and maximum static pressure of 125 Pa. The radiator shall be fitted with a flange for connecting to a canvas flex section and the fan shall be enclosed with a guard to prevent accidental contact.
 - .5 The cooling system shall be complete with a thermostatically controlled coolant heater to maintain engine jacket water at an even temperature throughout the block as recommended by the engine manufacturer.

2.10 GENERATING SET OPERATION

- .1 Program selector switch set at "Automatic".
 - .1 Upon start signal from transfer switch, cranking is to initiate within 5 seconds and engine is to remain running as long as transfer switch is indicating a utility power failure condition.
 - .2 On restoration of normal power signal from transfer switch, engine is to continue running for a cool down period for duration specified by the manufacturer.
- .2 Program Selector Switch set at "Manual"
 - .1 Start button controls engine but automatic transfer of load prevented.
 - .2 Manual transfer possible.
 - .3 Electrical transfer possible by use of power transfer switch.
- .3 Program selector switch set at "OFF".
 - .1 Engine will stop and not start.

2.11 SAFETY EQUIPMENT

- .1 Provide the following wall mounted safety equipment in the generator room:

- .1 Portable Eyewash Station: portable eyewash with solution, 1 litre capacity, wall mount storage case.
- .2 Hearing Protectors: External wear with adjustable head band, three pair, wall mounted on suitable hook beside door.

2.12 FUEL COOLING SYSTEM

- .1 Provide air-cooled return fuel cooling system as an integral part of the generator set package that ensures fuel returned to the fuel supply and storage system does not exceed 38 degrees C under normal operating conditions. Where the generator uses fuel oil to cool injectors, this is most likely required in order to meet the Oil Burner code. Other methods of complying with the code are acceptable where the method is in accordance with typical industry practice in Canada.

2.13 PERFORMANCE

- .1 System to be capable of maintaining a maximum voltage dip of 20% and maximum frequency dip of 10%, with 100% load pick-up in one step.
- .2 System is to be proto-type tested with test results submitted with shop drawings.
- .3 Irrespective of minimum size specified herein, generator set is to be capable of meeting all specified criteria under the following starting and running load profile plus 10% spare capacity:
 - .1 Step 1: 90 kVA (15 % inductive)
 - .2 Step 2: 10 HP motor (solid-state starting);

2.14 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Controls: Type B nameplates.
- .3 Meters, alarms, indicating lights: Type C nameplates.
- .4 Breaker: Type B nameplates.

2.15 FABRICATION

- .1 Shop assemble generating unit including:
 - .1 Engine;
 - .2 Engine cooling system;
 - .3 Alternator;
 - .4 Control cubicle;
 - .5 Automatic transfer switch;
 - .6 Battery charger and battery;
 - .7 Automatic engine room ventilation equipment;
 - .8 Fuel supply system;
 - .9 Engine exhaust system;
 - .10 Mounting base.
- .2 Generator set and all accessories are to be packaged suitable for all means of transportation by water and land.

2.16 FINISHES

- .1 Apply finishes in accordance with Section 26 05 01 - Common Work Results -

Electrical.

- .2 Alternator control cubicle: paint inside, exterior to match engine and alternator.
- .3 Exhaust and inlet air hoods international orange.
- .4 Other ducts and racks grey.
- .5 Supply 0.25L of grey touch-up enamel.

2.17 SOURCE QUALITY CONTROL

- .1 Factory test generator set including engine, alternator, control panels, ventilation, cooling and fuel systems and accessories per manufacturer instruction.
- .2 Where the transfer switch is not supplied by the generator manufacturer, simulate the function of transfer switch by using a real transfer switch and test the generator set accordingly.
- .3 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.
- .4 Run Tests:
 - .1 With 100% rated load, operate set for 4 h, taking readings at 15 min intervals for the three readings and 30 min intervals thereafter, and record following:
 - .1 Time of reading.
 - .2 Running time.
 - .3 Ambient temperature in °C.
 - .4 Lube oil pressure in kPa.
 - .5 Engine coolant temperature in °C.
 - .6 Alternator voltage: phase 1, 2, 3.
 - .7 Alternator current: phase 1, 2, 3.
 - .8 Power in kW.
 - .9 Frequency in Hz.
 - .10 Battery voltage.
 - .2 After completion of 4 h run, demonstrate and document the following shut down devices and alarms. For electronic shut-down devices that cannot practically be field tested, provide manufacturer's test sheet indicating that all tests have been completed and passed:
 - .1 Over cranking.
 - .2 Overspeed.
 - .3 High engine temp.
 - .4 Low lube oil pressure.
 - .5 Simulate short circuit response of the generator set. Destructive test is not necessary.

- .6 Alternator overvoltage.
- .7 Low battery voltage, or no battery charge.
- .8 Manual remote emergency stop.
- .9 High alternator temperature for the units equipped with thermistor.
- .10 Low engine temperature.
- .5 Start and Shut Down Test:
 - .1 Automatic starting of set and automatic transfer of load on failure of normal power.
 - .2 Manual operation of transfer switch.
 - .3 Automatic shut down of engine on resumption of normal power.
 - .4 Demonstrate that battery charger reverts to high rate charge after cranking.
 - .5 Test low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.
- .6 Demonstrate:
 - .1 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.
- .7

2.18 SPARE PARTS

- .1 Six (6) fuel filter replacement elements.
- .2 Six (6) oil filter replacement elements.
- .3 Six (6) air cleaner replacement elements.
- .4 Two (2) fuses of each type used in control panel.
- .5 Two (2) accessory belts of each type used on engine.
- .6 Special tools for unit servicing.

2.19 ENCLOSURE

- .1 Enclosure: Indoor type sprinkler proof.

2.20 GENERATOR OVERALL FOOTPRINT

- .1 The generator room, and subsequent cooling is sized to accommodate several different possible generators of the sizing required. Criteria for approval includes selection of a unit that will fit within the space, and has 1m working clearance in all directions. Notify the Departmental Representative during the bidding process if this cannot be achieved. Failing to do so, allow in the bid price, costs for extending the structure to accommodate the required dimensions.
- .2 Equal as indicated in this specification section applies to units that have the required performance and equal or smaller dimensions.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate generating unit and install as indicated.
- .2 Install fuel supply, ventilation and exhaust systems with Division 25.
- .3 Install ventilating air duct system as indicated.
- .4 Pipe muffler drains to nearest floor drain.

- .5 Complete wiring and interconnections as indicated.
- .6 Start generating set and test to ensure correct performance of components.
- .7 Install remote stop button inside the generator room at the entrance.
- .8 Provide raceway and wiring from the generator enclosure as necessary and install the remote annunciator at 1550 mm AFF.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical as well as CAN/CSA-C282 requirements and procedures.
- .2 Provide in tender price for testing and adjusting of unit on site with the assistance of the factory certified technician.
- .3 Tests shall be performed during the substantial completion field review by the engineer, and witnessed by him or her. Schedule the work at the outset of the construction so that work schedules are properly coordinated to guarantee this. Coordinate with other subtrades involved, such as but not limited to, automatic transfer switch installer to ensure attendance at the time of tests. Failed to do so in whole or in part, pay all engineer's costs whatsoever associated with witnessing the generator tests at other times.
- .4 Pretest the unit prior to request for substantial completion field review and troubleshoot all deficiencies. Submit a copy of successful pretesting along with the request for substantial completion review. Coordinate with other subtrades involved, such as but not limited to, automatic transfer switch installer to ensure their components and systems are installed, tested and ready for pretesting at the time of the pretests. Failed to do so in whole or in part, pay all engineer's costs whatsoever associated with performing additional site visit to witness successful testing of the generator at other times.
- .5 Notify Consultant 15 working days in advance of test date and time.
- .6 Arrange for facility's maintainer to be present during all tests.
- .7 Provide fuel for testing and leave full tanks on acceptance.
- .8 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. Simulate conditions required, jumpering out of alarm or shutdown devices alone is not acceptable.
 - .6 The room temperature remains between 10 and 40 degrees C.
- .9 Perform initial installation performance tests in accordance with part 10 of CSA-C282 and submit report including all observations and data recorded.
- .10 Perform Operational test as described in article 10.2 of the CSA-C282 for 1 hour and observe and record data as described therein. Submit report including all observations and data recorded.
- .11 Demonstrate load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling.

- .12 Perform full load test for 4 hours as described in article 10.3 of the CSA-C282. Provide portable load bank. Observe and record data as required by article 10.3.4 of the CSA-C282. Submit report including all observations and data recorded.
- .13 Crank cycle tests in accordance with manufacturer instructions as described in CSA-C282 Section 10.4. Submit report including all observations and data recorded.
- .14 Record the following on site in 15 minute intervals during four hour test under full load and submit readings to Engineer. The Engineer or the Engineers representative is to be on site during testing.
 - .1 Amps, L1, L2, L3.
 - .2 Voltage, L1-L2, L2-L3, L1-L3, L1-N, L2-N, L3-N.
 - .3 Coolant temperature
 - .4 Room temperature.
 - .5 Frequency
 - .6 Oil pressure.
 - .7 Time delay on re-transfer.
 - .8 Time delay on engine cool down and shut down.
 - .9 Battery charge rate.
- .15 Perform safety shutdown and alarms tests per article 10.5 of the CSA-C282. Observe and record data and submit report including all observations and data recorded.
- .16 A manufacturer's representative is not required on site by these documents if the contractor is certified to perform such tests. Ensure that the manufacturer's warranty remains valid under the testing conditions described in these contract documents.
- .17 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.
- .18 At the end of test while diesel is still warm change oil, air filter, oil filter and fuel filter. Clean and repaint where required except for exhaust manifold. Provide sample of used oil to owner for analysis and baseline reference.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of the standby generator unit, transfer loads and shut down of the standby unit.

1.2 ESPECIALLY RELATED SECTIONS

- .1 Section 26 05 48 - Seismic Restraints for Electrical Systems.

1.3 SYSTEM DESCRIPTION

- .1 Circuit Breaker-type automatic load transfer equipment to:
 - .1 Monitor voltage on all phases of normal power supply.
 - .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase above or below preset adjustable limits for adjustable period of time.
 - .3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.
 - .4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on all phases within an adjustable pre-set range for adjustable time period.
 - .5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay (may be eliminated if provided in generator controller).
 - .6 Enclosure: Indoor type sprinkler proof.
 - .7 Allow for switched maintenance bypass of the transfer switch to the emergency position.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples. Submit shop drawings for this section after the study specified in section 26 05 73 - Overcurrent Protective Device Coordination Study / Calibration received favorable review. Submittals prior to this will be rejected as insufficient information for review.
- .2 Include:
 - .1 Make, model and type.
 - .2 Single line diagram showing controls and relays.
 - .3 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 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .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 Indicate on drawings:
 - .1 Make, model and type.
 - .2 Load classification:
 - .3 Dimensions
 - .4 Ampere rating, fault bracing,
 - .5 Sequence of Operation:
 - .1 Automatic starting and transfer to standby unit and back to normal power.
 - .2 Test control.
 - .3 Manual control.
 - .4 Automatic shutdown.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 01 78 30 - Closeout Submittals.
- .2 Detailed instructions to permit effective operation, maintenance and repair.
- .3 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.

Part 2 Product

2.1 MATERIALS

- .1 Instrument transformers: to CAN3-C13.
- .2 Contactors: to ANSI/NEMA ICS2.

2.2 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT

- .1 Circuit Breaker Type Transfer Equipment: to CSA C22.2 No.5.
- .2 Three pole breakers mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, solenoid operated, with CSA type 1 enclosure with drip shield.
- .3 Rated: 240 V, 60Hz, 400 A, three phase, solid neutral.
- .4 Main contacts: silver surfaced, protected by arc disruption means.
- .5 Circuit Breaker contacts and control elements accessible for inspection and maintenance from front of panel without removal of components and power conductors.
- .6 Auxiliary contact: silver plated, to initiate emergency generator start-up on failure of normal power.
- .7 Fault withstand rating: 25 kA symmetrical for 3 cycles with maximum peak value of 25 kA. [as indicated on drawings].
- .8 Solid neutral bar, rated: 400 A.

- .9 Lever to operate switch manually when the switch is isolated.
- .10 Manual single-sided maintenance bypass switch that will permit bypass to the emergency source leaving the primary transfer switch mechanism isolated and available for maintenance or repair.

2.3 CONTROLS

- .1 Selector switch -4 position "Test", "Auto", "Manual", "Engine start".
 - .1 Test position - normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.
 - .2 Auto position - normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.
 - .3 Manual position - Allows for manual operation of transfer switch.
 - .4 Engine start position - starts diesel generator.
- .2 Control transformers: dry type with 120 V secondary to isolate control circuits from:
 - .1 Normal power supply.
 - .2 Emergency power supply.
- .3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:
 - .1 Voltage sensing: all phases for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2 V minimum undervoltage and over voltage protection.
 - .2 Time delay: normal power to emergency, adjustable solid state, 15 sec. Set at 0 to 60 s sec.
 - .3 Time delay on engine starting to override momentary power outages or dips, adjustable 0 to 60 sec delay. Set at 3 secs.
 - .4 Time delay on retransfer from emergency to normal power, adjustable 10 to 1800 s.
 - .5 Time delay for engine cool-off to permit emergency set to run unloaded after retransfer to normal power, adjustable 20 s intervals to 10 minutes (not required if part of engine control system).
 - .6 Frequency sensing, to prevent transfer from normal power supply until frequency of emergency unit reaches preset adjustable values.
- .4 Solid state electronic in-phase monitor.

2.4 ACCESSORIES

- .1 Digital display to indicate power availability normal and emergency, and switch position, mounted in panel.
- .2 Plant exerciser: 168 hours timer to start emergency unit once each week for selected interval but does not transfer load from normal supply. Timer adjustable 0-168 hours in 15 minute intervals.
- .3 Auxiliary relay to provide 2 N.O. and 2 N.C. contacts for remote alarms.
- .4 LCD display to indicate the following readings:
 - .1 Voltage phase to phase and phase to neutral.
 - .2 Phase current.

2.5 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results for Electrical.
- .2 Control panel:
 - .1 For selector switch and manual switch: Type B nameplates.
 - .2 For meters, indicating lights, minor controls: Type B nameplates.
 - .3 For description, voltage and ampacity of equipment: Type A nameplates.
 - .4 Nameplates to include: "Auto - Test - Manual - Engine Start" - for switch.

2.6 SOURCE QUALITY CONTROL

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested.
- .2 Tests:
 - .1 Operate equipment both mechanically and electrically to ensure proper performance.
 - .2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.
 - .3 Check voltage sensing and time delay relay settings.
 - .4 Check:
 - .1 Automatic starting and transfer of load on failure of normal power.
 - .2 Retransfer of load when normal power supply resumed.
 - .3 Automatic shutdown.
 - .4 In-phase monitor operation.

2.7 ENCLOSURE

- .1 Enclosure to be EEMAC 1 per CSA-C22.1 suitable for the location shown on drawings, and sprinkler proof.
- .2 The enclosure to facilitate necessary ventilation and natural cooling necessary for the proper operation of the equipment enclosed therein.

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 DCC 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 and adjust as required.
- .3 Check solid state monitors and adjust as required to ensure correct operation.

- .4 Install and connect battery.
- .5 Provide raceway and wiring and connect the auxiliary contacts to the elevator and emergency light in each lobby.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results for Electrical.
- .2 Tests shall be performed during the substantial completion field review by the Departmental Representative, and witnessed by him or her. Schedule the work at the outset of the construction so that work schedules are properly coordinated to guarantee this. Coordinate with other subtrades involved, such as but not limited to, generator installer to ensure attendance at the time of tests. Failed to do so in whole or in part, pay all Departmental Representative's costs whatsoever associated with witnessing the transfer switch tests at other times.
- .3 Pretest the unit prior to request for substantial completion field review and troubleshoot all deficiencies. Submit a copy of successful pretesting along with the request for substantial completion review. Coordinate with other subtrades involved, such as but not limited to, generator installer to ensure their components and systems are installed, tested and ready for pretesting at the time of the pretests.
- .4 Notify Consultant 15 working days in advance of test date and time.
- .5 Arrange for facility's maintainer to be present during all tests.
- .6 Energize transfer equipment from normal power supply.
- .7 Set selector switch in "Test" position to ensure proper emergency start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure emergency shuts down.
- .8 Set selector switch in "Manual" position and check to ensure proper performance.
- .9 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.
- .10 Set selector switch in "Auto" position and open normal power supply disconnect. Emergency should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for emergency minutes, then close main power supply disconnect. Load should transfer back to normal power supply and 10 should shutdown.

3.4 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .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 American National Standards Institute (ANSI)
 - .1 ANSI C82.1, Electric Lamp Ballasts - Line Frequency Fluorescent Lamp Ballast.
 - .2 ANSI C82.4, Ballasts for High-Intensity - Discharge and Low-Pressure Sodium Lamps.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
 - .1 ASTM F1137-88, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 United States of America, Federal Communications Commission (FCC):
 - .1 FCC (CFR47) EM and RF Interferences Suppression.
- .5 Canadian Standards Association (CSA International)
- .6 ICES-005-07, Radio Frequency Lighting Devices.
- .7 Underwriters' Laboratories of Canada (ULC)

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Engineer.
- .3 Photometric data to include: VCP Table.
- .4 Product data to include: total input watts, candlepower summary, candela distribution zonal lumen summary, luminaire efficiency, CIE (International Commission on Illumination) type, coefficient of utilization, lamp type, and lumen rating in accordance with IESNA testing procedures.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .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 following in accordance with Section 01 45 00 - Quality Control.
 - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common

Product Requirements.

- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return of crates in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Product

2.1 LAMPS

- .1 Fluorescent lamps:
 - .1 T8 Fluorescent lamps: Color temperature of 4100K, 80 CRI, Medium Bi-pin base, 40,000 hours life, 2950 initial and 2800 mean lumens, T8-32/1219mm. 4141
- .2 Metal halide lamps: Voltage and wattage sized per fixture requirements. Color temperature of 3200K coated.

2.2 BALLASTS

- .1 General:
 - .1 Provide ballasts rated for specified lamps.
 - .2 Thermal protection: Internal UL Class 'P' with automatic reset.
 - .3 Input voltage: Match branch circuit supply voltage; refer to drawings.
 - .4 Provide quantity of ballast to provide switching as indicated on drawings.
 - .5 Provide factory printed wiring diagram on ballast housing.
 - .6 Use Type 1 construction ballasts in enclosed and gasketed luminaires.
 - .7 Provide ballasts that withstand input power line transients per ANSI C62.41, Category-A and IEEE 587.
 - .8 Class "A" sound rating.
 - .9 Shall comply with FCC title 47 CFR part 18 and NEMA EMI and RFI limits.
 - .10 For remote mounted ballasts ensure that the conductor from the ballast to the lamp is sized according to the manufacturers requirements based on the actual installed distance.
- .2 Fluorescent ballast:
 - .1 CBM and CSA certified, energy efficient type, IC electronic design providing rated lumen output and rated life of the lamp.
 - .2 120V or 347V as specified for particular luminaire, with input frequency of 60Hz and lamps operating at 20,000 to 60,000Hz to minimize flicker but outside 30,000 to 42,000 Hz to avoid interference with infrared devices.
 - .3 Harmonic distortion less than 10% of the fundamental phase current, power factor greater than 0.98, crest factor less than 1.7 and ballast factor of 88% or higher.
 - .4 Maximum case temperature 70°C.
- .3 High intensity discharge ballasts: Low noise high-efficiency type to ANSI C82.4 design. 120V or 208V as specified for particular fixture design, single lamp of the constant wattage high power factor type. Start-up current to be not greater than 110% of full load running current.

- .4 Metal halide ballast:
 - .1 Rating: voltage as indicated, for use with 1-400W metal halide lamp. Provide circuitry for quartz re-strike standby light where indicated.
 - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
 - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
 - .4 Type: isolated secondary.
 - .5 Input voltage range: plus or minus 10% of nominal.
 - .6 Minimum starting temperature: minus 30 degrees Celsius at 90% line voltage.
 - .7 Mounting: remote.
 - .8 Current crest factor: 1.7 maximum current.
- .5 LED Drivers and Fixtures:
 - .1 To have manufacturer's warranty of a minimum of 5 years.
 - .2 Design Lights Consortium (DLC) listed.
 - .3 Tested and compliant with L70 or LM79 or LM80 standards, with testing conducted by an outside testing facility with no connection to the manufacturer.

2.3 FINISHES

- .1 Baked enamel finish:
 - .1 Conditioning of metal before painting:
 - .1 For corrosion resistance conversion coating to CGSB 31-P-103M.
 - .2 For paint base, conversion coating to CGSB 31-GP-105M, CGSB 31-GP-106a.
 - .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel polyester powdercoat alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.
 - .3 Reflector and other inside surfaces finished as follows:
 - .1 White, minimum reflection factor 85%.
 - .2 Colour fastness: yellowness factor not above 0.02 and after 250 h exposure in Atlas fade-ometer not to exceed 0.05.
 - .3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.
 - .4 Gloss not less than 80 units as measured with Gardner 60° gloss meter.
 - .5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.
 - .6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

2.4 LIGHT CONTROL DEVICES

- .1 Design:
 - .1 Lens thickness: 2.41 mm minimum or as indicated.
 - .2 Material: injection moulded clear virgin acrylic, prismatic glass, opal glass, or as indicated in luminaire schedule.

- .3 Frame: hinged, gasketed, latched, die cast, steel or aluminum, as indicated in luminaire schedule.
- .4 Type: reflector.

2.5 LUMINAIRES

- .1 See schedule on drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Check the ceiling types by referring to architectural drawings prior to ordering material. Inform engineer of any discrepancies between the electrical drawings and ceiling types immediately and request clarification. Provide all necessary accessories for mounting the specified luminaires on the ceiling type in each space.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Armoured cable (BX) may be used for drops to luminaires in accessible ceiling space.
 - .2 Provide extra length of armoured cable securely coiled in accessible ceiling space to allow relocation of the luminaire within a 2m radius at no extra cost.
 - .3 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling.
- .2 Support fluorescent luminaires mounted in continuous rows once every 1.219 m.
- .3 Provide safety chain or cable, in addition to standard mounting method, for all luminaires mounted higher than 4 m above the finished floor in shops, warehouses, gymnasiums, arenas, etc.

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 Focus and adjust all adjustable luminaires, at presence of Departmental Representative, at such time of day or night as required.
- .4 Clean paint splatters, dirt, dust, fingerprints and debris from luminaires.
- .5 Where finish of luminaire has been damaged, touch up finish per manufacturer instructions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for emergency lighting systems.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).

1.3 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Data to indicate system components, mounting method, source of power and special attachments as well as battery charge and discharge voltage/time characteristics.
- .3 Submit operation and maintenance data in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.

Part 2 Products

2.1 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 V AC, 60 Hz.
- .3 Output voltage: 12 V DC.
- .4 Operating time: 120 minutes, and to produce not less than 91% of nominal DC system voltage with AC supply 'off'.
- .5 Battery: sealed, long life 10 year maintenance free life expectancy.
- .6 Battery Capacity:
 - .1 BP # 1: Minimum 200W, 12VDC or as required to power all connected loads for a minimum of 2 hours.
- .7 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
- .8 Solid state transfer circuit.
- .9 Automatic self-diagnostic circuitry.
- .10 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .11 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .12 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: MR16, 4W.LED
- .13 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.
- .14 Finish: White.
- .15 Auxiliary equipment:
 - .1 Voltmeter.
 - .2 Test switch.
 - .3 AC input and DC output inside cabinet.
 - .4 Brownout protector.
 - .5 Low voltage disconnect.

- .16 Battery Charger:
 - .1 Automatically maintain battery in fully charged state while main power available. Maintain DC float voltage within plus or minus 1% of setting, no load to full load, during main voltage variations of plus 10% to minus 10% and frequency variations of plus or minus 5%.
 - .2 Equalize charging rate such that after battery has provided full power output for specified duration, charger returns battery to 95% of fully charged state in 12 h.
 - .3 Automatic cycle test providing 12 discharges per year.
- .17 LED indicators:
 - .1 Amber LED: unit ready and trouble free and Audible Alarms (flashing); charging mode failure (on); master card failure (off).
 - .2 Green LED Test in progress: delay TDR; equalize mode.
 - .3 Red LED: battery low.
 - .4 Audible alarm: Any failure shall be followed by a pulsating audible alarm on for 3 seconds every two and one half minutes (2 1/2) until the failure is repaired.
- .18 Remote Heads: surface mount vandal resistant Lexan, fully adjustable, c/w MR16, 4W LED, glare free, and minimum 800 lumen output lamps. Double heads.
- .19 2-hr rated units to have integral TVSS protection on supply side.

2.2 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: Type RW90 XLPE in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized to be #10 AWG minimum.

Part 3 Execution

3.1 INSTALLATION

- .1 Identify conductors for polarity and voltage.
- .2 Install with conductors sized to maintain current flow with maximum 3% voltage drop.
- .3 Install central and remote heads per CEC rule 46-304 and as indicated on drawings and make all required connections to heads.
- .4 Direct light heads to suit site condition and check operation.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Include: Performance test for 2 hours.
- .3 Include a copy of the test report in the O&M manuals.
- .4 Units will be tested during the substantial completion field review by the engineer. Schedule the work at the outset of the construction so that work schedules are properly coordinated to guarantee this. Coordinate with other subtrades involved to ensure attendance at the time of tests.

- .5 Pretest the units prior to request for substantial completion field review and troubleshoot all deficiencies. Submit a copy of successful pretesting along with the request for substantial completion review. Coordinate with other subtrades involved to ensure their components and systems are installed, tested and ready for pretesting at the time of the pretests.
- .6 Notify Departmental Representative 15 working days in advance of test date and time.
- .7 Arrange for facility's maintainer to be present during all tests.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Provision of spare parts, devices and components as indicated herein.

Part 2 Products

2.1 MOTOR STARTERS

- .1 Three (3) spare fuses of each type and size used.
- .2 One (1) set of each type of adjustable thermal overload device.
- .3 One (1) spare coil of each starter size.
- .4 Two (2) spare control transformers.
- .5 One spare time delay device of each type used.

2.2 SPARE PARTS

- .1 Six (6) fuel filter replacement elements.
- .2 Six (6) oil filter replacement elements.
- .3 Six (6) air clearner replacement elements.
- .4 Two (2) fuses of each type used in control panel.
- .5 Two (2) accessory belts of each type used on engine.
- .6 Special tools for unit servicing.

2.3 OTHER SPARE PARTS

- .1 Provide additional spare parts recommended by the manufacturer for systems other than listed herein before.
- .2 Provide One (1) set of spare fuses for each type, used in the project.
- .3 Provide spare parts as indicated in other sections of this specifications.

Part 3 Execution

3.1 VERIFICATION

- .1 Assemble all listed parts at one location at the time of interim inspection for verification by the Departmental Representative and building maintainer.
- .2 Prepare typewritten list of all spare parts provided and present at time of inspection for witnessing and signature by building maintainer. Include one copy of signed list in each copy of O & M manuals.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association, (CSA International)
- .2 Telecommunications Industry Association (TIA)

1.2 SYSTEM DESCRIPTION

- .1 Structured system of telecommunications cables installed within buildings for distributing voice and data signals.
- .2 Installed in physical star configuration with separate horizontal and backbone sub-systems. Horizontal cables link work areas to telecommunications closet located on same floor. Telecommunications closets linked to central equipment room by backbone cables.
- .3 Provide a manufacturer-certified, telecommunications distribution system for voice and data as indicated on the drawings and specified herein.
- .4 System to provide an operating level and meet installation criteria as defined by the ANSI/TIA/EIA-568-B standard to Cat 6 level.
- .5 System is limited to cabling installations between communication outlets and Telecommunication Rooms and any accessory wiring specifically indicated herein or on drawings.
- .6 All components of the system shall be from the same manufacturer.
- .7 All electronics by the Owner (NIC).

1.3 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Submit labeling for all equipment, devices and systems for review at the outset of the construction along with product data sheets.

1.4 ABBREVIATIONS

- .1 ZSW: Station Wire.
- .2 CBC: Communication Building Cable.
- .3 STP: Shielded Twisted Pair.
- .4 UTP: Un-shielded Twisted Pair.
- .5 PCC: Premises Communications Cable.
- .6 OFC: Optical Fiber Cable.
- .7 CXC: Coaxial Cable.
- .8 EMI: Electromagnetic Interference.
- .9 RFI: Radio Frequency Interference.

Part 2 Products

2.1 STATION WIRE (ZSW)

- .1 4-pair, 24 AWG, 100 ohm cable with insulated copper conductor in separate outer jacket: to C22.2 No. 214. FT-4 fire-rated jacket.
- .2 Voice-grade electrical transmission requirements: to CSA T529.

.3 Date-grade electrical transmission requirements to: CSA T529.

2.2 UNSHIELDED TWISTED PAIR (UTP) CABLE

.1 4-Pair Category 6, Gigabit Ethernet, to ANSI/EIA/TIA/538B 2-1 with FT4 flame spread rating.

2.3 SHIELDED TWISTED PAIR (STP) CABLE

.1 2 pair 150 ohm cable: to CSA-T529.

2.4 COMMUNICATIONS FLAT CABLE (CFC)

.1 2 pair 22 AWG insulated copper conductors in separate flat outer jacket.

2.5 COMMUNICATIONS BUILDING CABLE (CBC)

.1 25 pair 22 AWG insulated copper conductors grouped in 25-pair separately identified modules surrounded by metallic tape shield and covered with thermoplastic jacket: to CAN/CSA C22.2 No. 214 and CSA T529. FT-1 fire rated jacket.

.2 Voice-grade electrical performance to: CSA-T529.

2.6 CONNECTORS

.1 At each outlet designated on the drawings as a structured wiring outlet provide two eight (8) position Cat 6 modular jacks, unless otherwise noted.

.2 Provide jacks in colours that match existing colour scheme. In the absence of a standard provide ivory.

.3 Provide White plastic cover plates for telecommunication outlets. Outlets to be identified on plates as to use with identification labels as indicated on drawings and in this specifications.

.4 Connectors to be wired to T568 A configuration.

2.7 PATCH PANELS

.1 Patch Panels in LAN/Communications Room to be mounted on hinging wall mounted 19" racks as indicated on drawings.

.2 Patch panels to be suitable for use with Category 6 Enhanced Ethernet with IDC terminations and 8 position jacks, with 48 ports per panel. Patch panel jacks to be wired to T568 A configuration.

2.8 PATCH CORDS

.1 Provide patch cords in compliance with the manufacturer's certification. Use patch cords certified by the manufacturer for meeting Category 6 Ethernet requirements.

.1 Provide patch cords as required to connect all jacks to their appropriate system (telephone or LAN) as is indicated on the drawings.

.2 Patch cords used for telephone are to be yellow in colour.

.3 Patch cords used for data (LAN) are to be blue in colour.

.4 Provide forty (40) 2 m long patch cords of each colour.

2.9 IDENTIFICATION

.1 Identify each cable by a unique code as specified herein, identify cable at each end of it's length. Utilize pre-coded self adhesive vinyl tape for cable identification.

.2 Identify each telecommunications jack by a unique code as specified herein. Identify each jack using label plates with self-adhesive or built-in-plate labels according to

- labeling scheme specified herein.
- .3 Identify each telecommunications conduit by a unique code as specified herein. Conduits are to be tagged with lamiciods such that the lamicioid does not obstruct the conduit throat.
 - .4 Identify each telecommunications cable tray by a unique code as specified herein. Tag trays with lamiciods such that the lamicioid does not obstruct the cable installation.
 - .5 Identify each patch panel by a unique code as indicated on the drawings and specified herein. Utilized lamicioids with 9.5mm high lettering.
 - .6 Identify each telecommunications jack on all patch panels by a unique code as specified herein, which matches the corresponding outlet jack. Use self-adhesive or built-in-plate labels according to labeling scheme specified herein.
 - .7 Identify each telecommunications outlet jack by a unique code as specified herein. Use self adhesive labels or built-in-plate labels according to labeling scheme specified herein.
 - .8 Identify each telecommunications outlet using the identical method as the original and existing installation.

2.10 RECORDS

- .1 Provide an Administrative Cable Database for the structured wiring system. The cable record to indicate identifier, termination points, cable use, cable number, cable path from end to end, cable length and test report number for each cable. Database to be both printed and electronic format including labeling according to TIA/EIA-606 and as follows:
 - .1 Identify each wired outlet jack uniquely as JCXXXYY where J indicates "jack", C indicates "copper", XXX indicates three digit room number where the jack is located, and YY indicates sequential unique number of jack within the associated room.
 - .2 Identify each cable by unique code as CXXXYY where C indicates "cable" and XXX indicates three digit room number where associated jack is located and YY indicates two digit number that matches that of the connected jack.
 - .3 Each and every conduit and cable tray path that is followed by the cable from the outlet jack to the telecommunication closet is to be recorded using the pathway identifiers shown on the drawings.
 - .4 Identify the label of the patch panel port to which each cable is connected as XXX-YY where XXX indicates patch panel identifier shown on drawings and YY indicates port number on the associated panel.
- .2 Provide three ring binder with tabs for hard copy of administrative cable database, as built drawings and cable test reports.
- .3 The administrative labeling database is to be provided in Microsoft Access or Excel format.

2.11 RECORD DRAWINGS

- .1 Record drawings to be CADD drawings of drafting quality matching to those issued to contractor. Drawings shall show all cabling, terminations and labeling for jacks, conduit pathways, cable trays, patch panels and telecommunications rooms.

Part 3 Execution

3.1 INSTALLATION

- .1 Install all telecommunications cabling in concealed spaces in conduit, and on cable tray where shown on drawings.
- .2 From each communication outlet run number of cables indicated on drawings to patch panels as noted. Connect cables to patch panels as noted.
- .3 Cabling from outlets to telecommunications rooms to be four pair UTP.
- .4 Clean raceway system prior to installing wiring.
- .5 Do not exceed manufacturer recommended maximum pull force.
- .6 Maintain minimum bending radius recommended by the manufacturer.
- .7 Provide strain relief and routing guides per applicable standards.
- .8 Provide identification for cable at both ends and where it enters a pull box. Provide identification every 15 m for cables installed on the tray and at both sides where cable passes through conduit sleeves.
- .9 Provide identification for jacks and patch panels.
- .10 Use cable straps and bundle cables in accessible ceiling space.
- .11 Ground all patch panels and racks per applicable codes.
- .12 Provide fire stopping to code requirements at fire separations.
- .13 Leave pull string in all occupied and unoccupied conduits.
- .14 Maintain the cable manufacturer recommended separation between cable and sources of EMI and RFI.
- .15 Ensure that the cable is not flattened, squeezed, or crimped.
- .16 Tie wrap cables using Velcro wraps. Nylon tie is not acceptable.
- .17 Use specific tools recommended by manufacturer for each connector type.
- .18 Ensure that the connector strain relief provisions, as recommended by manufacturer, are used.
- .19 Strip jackets no more than the minimum required per manufacturer instructions. Maintain pair twist as much close to the termination as recommended by manufacturer.
- .20 Mount patch panels in orderly fashion. Submit layouts for approval prior to installation.
- .21 Ground patch panels as recommended by manufacturer and required by code.
- .22 Attach horizontal wiring to patch panel in an orderly fashion.
- .23 Mount patch panels to racks with as many screws as there are mounting holes or slots in panel.
- .24 Provide necessary strain reliefs and cable support brackets, plus trays for fiber cable loop behind panel and install cables utilizing such devices.
- .25 Complete records and record drawings for each component in system and compile binder.
- .26 Do not exceed the maximum cable length of 90 m. Inform Departmental Representative and request directions prior to rough in when a run appears to exceed 90 m.

3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

- .1 Install ZSW horizontal cables, as indicated in conduits from termination in telecommunications closet to outlets.
- .2 Install ZSW cables, as indicated in telecommunications closet.
- .3 Terminate 1 ZSW cables per work station terminated in accordance with CAN/CSA C22.2 No.182.4 and CSA-T529.
- .4 Terminate STP cable in accordance with CSA-T529.
- .5 Install CFC cables under carpet from wall termination points.
- .6 For distribution of television signals, terminate CXC cable on type F connectors. For distribution of data signals, terminate CXC cable in accordance with CSA-T529.
- .7 Terminate OFC cables with ST connectors.

3.3 INSTALLATION OF BACKBONE CABLES

- .1 Install CBC cable, as indicated in conduit from termination in each telecommunications closet to equipment room. Termination: to CSA-T529.
- .2 Terminate CBC cables in accordance with CSA-T529 on IDC connectors.
- .3 For distribution of television signals, terminate CXC cable on type F connectors. For distribution of data signals, terminate CXC cable in accordance with CSA-T529.
- .4 Terminate OFC cables on patch panel with ST connectors.
- .5 Provide identification for cable at both ends and where it enters a pull box.
- .6 All applicable items of article 3.1 applies to this article as if repeated herein.
- .7 Provide pull string in all backbone conduits for future use.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Testing:
 - .1 Each cable to be tested for compliance to criteria as stated within TIA/EIA-568-B.
 - .2 Provide printed report of all cables verifying that they meet the Category 6 standard requirements. Place in manual with system records.
 - .3 Provide electronic records of all reports in the format of a current and commonly used database.
 - .4 Test and verify the performance of the fiber link per ANSI/TIA/EIA-526-14-A, ANSI/TIA/EIA-568-B.3 & B.3-1, and TIA/EIA TSB-140.
 - .5 Test the telephone cable per manufacturer instructions and the applicable TIA/EIA standards.
 - .6 All modifications to existing system are to be compatible with existing certified installation. Warranty for existing system is not to be compromised by new work, and all new work is to be certified and guaranteed within warranty of existing system.
- .3 Provide electronic records of all test reports in the same format as of the administrative cable database records. Include a copy of the test results in the operation and maintenance manuals.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 NBC, National Building Code of Canada.
- .2 CSA C22.1, Canadian Electrical Code.
- .3 Government of Canada:
 - .1 TB Chapters 3 & 4, Standard Fire Alarm Systems.
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524, Installation of Fire Alarm Systems.
 - .2 ULC-S525, Audible Signal Appliances for Fire Alarm.
 - .3 ULC-S526, Visual Signal Appliances For Fire Alarm Systems.
 - .4 CAN/ULC-S527, Control Units For Fire Alarm Systems.
 - .5 CAN/ULC-S528, Manual Pull Stations.
 - .6 CAN/ULC-S529, Smoke Detectors For Fire Alarm Systems.
 - .7 CAN/ULC-S530, Fire Detectors, Heat Actuated, For Fire Alarm Systems.
 - .8 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.
 - .9 CAN/ULC-S537, Verification of Fire Alarm Systems.
 - .10 ULC-S541, Speakers for Fire Alarm Systems.
 - .11 CAN/ULC-S531, Smoke Alarms.
 - .12 CAN/ULC-S561, Installation and Services for Fire Signal Receiving Centres and Systems.

1.2 DESCRIPTION OF SYSTEM

- .1 Fully supervised, addressable, Class A, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital multiplexing techniques for data transmission.
- .2 System includes:
 - .1 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signaling to monitoring agency.
 - .2 Trouble signal devices.
 - .3 Power supply facilities.
 - .4 Manual alarm stations.
 - .5 Automatic alarm initiating devices.
 - .6 Audible signal devices.
 - .7 Visual signal devices.
 - .8 Audio-visual alarm signal devices.
 - .9 End-of-line devices.
 - .10 Loop Isolation modules.
 - .11 Annunciators.
 - .12 Ancillary devices - Spare contacts for:
 - .1 Digital Alarm Communicator Transmitter (DACT)
 - .2 Air handling units shut-down

- .3 Door release devices
- .4 Signal alarm and trouble at the building's control & automation system.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- .1 System:
 - .1 To Fire Commissioner of Canada approval and final acceptance.
- .2 System components: listed by ULC, bear the ULC label and comply with applicable provisions of National Building Code with Local and Provincial amendments, CAN/ULCS524 standard for the installation of fire alarm systems, Canadian Electrical Code C22.1; part I and meet requirements of local authority having jurisdiction.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Shop Drawings, Product Data, and Samples.
- .2 Include:
 - .1 Detail assembly and internal wiring diagrams for control unit.
 - .2 Overall system riser wiring diagram identifying control equipment initiating zones signaling circuits; identifying terminations, terminal numbers, conductors and raceways.
 - .3 Details for devices.
 - .4 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.
 - .5 Step-by-step operating sequence, cross referenced to logic flow diagram.
 - .6 Battery capacity calculations.
 - .7 Manufacturer recommended testing material, devices, equipment and methods for smoke and heat detectors.
- .3 Shop drawings to be stamped by manufacturer to ensure equipment/design is in accordance with ULC standards.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Section 01 78 30 - Closeout Submittals.
- .2 Include:
 - .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings.
 - .4 Certificate of verification.
 - .5 List of recommended spare parts.
- .3 NOTE: Photostat copies of manuals or drawings shall not be accepted. Manuals to contain information applicable only to the system covered in these documents.
- .4 Installer to provide drawing of building plan showing all fire alarm zones. As described in Section 26 05 00 - Common Work Results - Electrical.

1.6 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 30 - Closeout

Submittals.

- .2 Include: 5 spare break-glass rods for manual pull stations if applicable.

1.7 MAINTENANCE

- .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Owner.

1.8 ENCLOSURE

- .1 Enclosure to be EEMAC 1 or EEMAC 3 as per CSA-C22.1 suitable for the location shown on drawings, and sprinkler proof.
- .2 The enclosure to facilitate necessary ventilation and natural cooling necessary for the proper operation of the equipment enclosed therein.
- .3 Ensure that the rough in is installed properly to allow installation of the panel and the trim neatly.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and devices: ULC listed and labeled and supplied by single manufacturer.
- .2 Power supply: to CAN/ULC-S524.
- .3 Audible signal devices: to ULC-S525.
- .4 Visual signal devices: to CAN/ULC-S526.
- .5 Visual signal devices: to CAN/ULC-S526.
- .6 Manual pull stations: to CAN/ULC-S528.
- .7 Thermal detectors: to CAN/ULC-S530.
- .8 Smoke detectors: to CAN/ULC-S529.
- .9 Smoke alarms: to CAN/ULC-S531.
- .10 DACT: to CAN/ULC-S561.

2.2 SYSTEM OPERATION

- .1 Single stage operation. Operation of any alarm initiating device to:
 - .1 Cause audible and visual signal devices to operate continuously throughout building, at fire alarm panel and annunciators.
 - .2 Transmit signal to buildings and central monitoring station via DACT. Number to be provided by owner and programmed by this division.
 - .3 Cause zone of alarm device to be indicated on control panel.

2.3 CONTROL PANEL

- .1 Class A.
- .2 Single stage operation.
- .3 Zoned.
- .4 For use with addressable devices.
- .5 Non-coded.
- .6 Enclosure: CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.
- .7 Supervised, modular design with plug-in modules:

- .1 Alarm receiver with trouble and alarm indications provision for remote supervised annunciation, for class A initiating circuit.
- .2 Spare Zones: Compatible with smoke detectors and open circuit devices.
- .3 Space for future modules. Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.
- .8 Visual indication:
 - .1 Zone LEDs for trouble and alarm for each separate zone.
- .9 Components:
 - .1 Alarm receiver panel with trouble and alarm indications for class A initiating circuit.
 - .2 Audible signal control panel with initiating control circuits complete with terminals for wiring and 2 plug-in modules for dc signals up to 2.0 A load with trouble indication with class A connections.
 - .3 Common control and power units:
 - .1 Control panel containing following indications and controls:
 - .1 "Power on" LED (green) to monitor primary source of power to system.
 - .2 "Power trouble" indication.
 - .3 "Ground trouble" indication.
 - .4 "Remote annunciator trouble" indication.
 - .5 "System trouble" indication.
 - .6 "System trouble" buzzer and silence switch c/w trouble resound feature.
 - .7 System reset switch.
 - .8 "LED test" switch if applicable.
 - .9 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.
 - .10 "Signals Silenced" indication.
 - .2 Master power supply panel to provide 24 V dc to system from 120 V ac, 60 Hz input.
 - .4 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit and c/w individual bypass switch.
 - .1 Contacts: 2.0 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down.
 - .2 Contact terminal size: Capable of accepting 22-12 AWG wire.

2.4 **POWER SUPPLY**

- .1 120V, ac, 60Hz input, 24Vdc output from rectifier to operate alarm and signal circuits, with standby power of gel cell batteries minimum expected life of 5 years, sized in accordance with NBC to operate system under supervisory load conditions without recharging for 24 consecutive hours and have sufficient power left to operate sounding devices for 30 minutes. Battery bank and charger to be integrally mounted in main fire alarm control panel.

2.5 **MANUAL ALARM STATIONS**

- .1 Manual alarm stations: Addressable, pull lever, glass rod, wall mounted semi-flush type, non-coded single pole normally open contact for single stage initiation. English signage.
- .2 Weatherproof type to be suitable for wet environment with falling water and include clear, hinged or tethered cover suitable for immediate removal.

2.6 AUTOMATIC ALARM INITIATING DEVICES

- .1 Addressable intelligent multi-sensor fire detector.
 - .1 Ionization sensor: Unipolar 0.135iC Americium 241.
 - .2 Heat sensor: To alarm at 35°C above the ambient temperature.
 - .3 Sensitivity: 0.67% to 3.7% obscuration/ft.
 - .4 Five level sensitivity setting. Set to normal sensitivity at 2.5%/ft.
 - .5 Pre-alarm sensitivity: 75% of alarm sensitivity setting.
 - .6 LED operation:
 - .1 On-board green LED - Flashes when polled.
 - .2 On-board red LED - Flashes when in alarm.
 - .7 Address: To use one device address.
 - .8 Electronics to communicate detector's status to addressable module/transponder.
 - .9 Detector address to be set on detector head in field.
 - .10 Layouts are based on 83 m2 coverage detector. Adjust quantity if smaller coverage is used. Do not change if coverage is larger than 83 m2.
- .2 Addressable fixed temperature thermal fire detectors: restorable fixed temperature element fixed temperature 57°C or 93°C.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector head in field.
- .3 Addressable thermal fire detectors: combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 °C, rate of rise 9°C per minute.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector head in field.
- .4 Addressable smoke detector.
 - .1 Dual chamber Ionization type.
 - .2 Electronics to communicate detector's status to addressable module/transponder.
 - .3 Detector address to be set on detector head in field.
 - .4 Layouts are based on 83 m2 coverage detector. Adjust if different coverage is used.

2.7 AUDIO/VISUAL SIGNAL DEVICES

- .1 Integral Strobe: flashing, output candela rating as indicated on drawing. Minimum 15 cd output rating. Field adjustable to 30, 75 or 110 cd.
- .2 Horn: temporal output, high-low adjustable up to 99 dB. Factory built to 99 dB, which could be field changed to 94 dB by cutting a circuit board jumper.

- .3 Designed for surface mounting on walls as indicated, 24V dc, Red housing.
- .4 Exterior, weatherproof type where indicated on drawings. To be capable of operating from -40°C to +30°C temperatures, water resistant.

2.8 END-OF-LINE DEVICES

- .1 End-of-line devices to control supervisory current in signal circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.9 ISOLATOR MODULES

- .1 Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on a Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the loop segment or branch. Isolators are to be located as specified herein and where shown on the drawings.
- .2 If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the signaling line circuit. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- .3 The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

2.10 REMOTE ANNUNCIATOR PANELS

- .1 Provide and install Fire alarm annunciator with individual device addresses matching those as on the main control panel. Zoning is to follow the contract drawings and as such is to match the drawing specified under section 26 05 00 - Common Work Results - Electrical.
- .2 Visual indication:
 - .1 Same as main control panel
 - .2 LED type with designation cards to indicate zone. LED test button. LEDs to annunciate alarm and trouble.
 - .3 Capable of displaying a minimum of 8 system events simultaneously.
- .3 Wired in multiple with main control panel.
- .4 Supervised, including trouble signal for open circuit.

2.11 MONITORING MODULES

- .1 Addressable devices for receiving dry contact inputs from other devices or equipment for signalling trouble, supervisory or alarm conditions on the fire alarm panel via the addressable initiating loop.
- .2 To be self-contained and powered from the initiating loop

2.12 AS-BUILT RISER DIAGRAM

- .1 Fire alarm system riser diagram: in glazed frame minimum size 600 x 600 mm.
- .2 Provide at the main fire alarm panel and each remote annunciator.
- .3 The zoning plan to show each building on the site with its name and number as well as the associated fire alarm zone.

2.13 CONTROL MODULES FOR ANCILLARY DEVICES

- .1 Remote relay unit to initiate fan and HVAC units shutdown.
- .2 Remote relay unit to initiate control of ancillary devices such as fan shut-downs, remote signalling and other systems requiring control by the fire alarm panel.
- .3 To be addressable device on the initiating loop with relay output contacts for connection to ancillary equipment.
- .4 Remote relay units and accessories to signal alarm and trouble at the building's control & automation system.

2.14 DATA GATHERING PANELS

- .1 Fire control modules: distributed throughout building in separately enclosed units (DGP'S) and interconnected to central control unit utilizing multiplex datatransmission techniques.
- .2 Modules: concentrated in single central location in modular central control panel.
- .3 Fire alarm integrated DGP's: microprocessor based, provide interface between standard alarm input/output devices and central control unit.
- .4 Each DGP: circuitry with ability to detect failure in communication with CCU resulting from faults in communication wiring. In event of loss of communication with CCU, DGP capable of operating in stand-alone mode. In this mode, DGP capable of reacting to connected input devices, and apply stand-alone programming to determine state of connected outputs. Stand-alone programming instructions: independent of, but capable of executing same type of algorithms as, that of CCU.
- .5 Each DGP: self-contained unit, with integral power supply, battery charger and standby batteries. Short circuit, over voltage, and brown-out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.
- .6 Addressable DGP's.

2.15 DIGITAL ALARM COMMUNICATOR TRANSMITTER FOR APPROVED CENTRAL STATION

- .1 Provide DACT with the following features:
 - .1 Solid state, user programmable automatic dialer.
 - .2 Each channel to be capable of being individually configurable for alarm on "contact close", "contacts open" or "no alarm".
 - .3 Operable on both touch-tone and rotary dial, standard telephone lines.
 - .4 System to be fully compatible with a ULC-approved central monitoring station.
 - .5 Device is to be ULC listed in accordance with CAN/ULC-S561 - Installation and Services for Fire Signal Receiving Centres and Systems.
 - .6 DACT to be complete with dual phone line module. Please note that not all autodiallers could be certified for every monitoring centre and therefore, it is important that the contractor coordinates with the monitoring company of the Owners choosing and provide the compliant product programmed for the monitoring centre.
- .2 Provide 120Vac primary transformer for use with DACT with secondary voltage as required by manufacturer.

- .3 The DACT power supply to be complete with battery charger and back-up battery with sufficient capacity in accordance with CAN/ULC-S561.
- .4 Each of the following systems shall activate separate DACT channels with separate message:
 - .1 Fire alarm trouble, supervisory and alarm signals;
 - .2 Mechanical alarm system.

Part 3 Execution

3.1 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.
- .2 Use armoured fire alarm cable for connections exposed to mechanical injury. Use conduit and fire alarm cable everywhere else.
- .3 Install main control panel and connect to ac power supply, dc standby power. Mount control panel such that top edge is at 1800 mm above finished floor.
- .4 Locate and install manual alarm stations and connect to alarm circuit wiring. Mount at 1200mm above finished floor.
- .5 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .6 Connect alarm circuits to main control panel.
- .7 Locate and install audio/visual signal devices and exterior horn and connect to signaling circuits. Mount audio/visual devices at not less than 2000 mm above floor level.
- .8 Connect signaling circuits to main control panel.
- .9 Install end-of-line devices at end of alarm and signaling circuits.
- .10 Install remote annunciator panels and connect to annunciator circuit wiring.
- .11 Locate and install remote relay units to control fan shut down.
- .12 Locate and install remote relay units to control elevator return, automatic door closers, and autodialer.
- .13 Provide two separate 16 mm conduit each containing one telephone line wiring from telephone system to the DACT and tie-in to a separate channels on the DACT. Verify operation.
- .14 Provide 16 mm conduit and telephone wiring to the voice autodialer and tie-in. Verify operation.
- .15 Each device to be permanently labeled:
 - .1 Zone Isolation Module: Indicate Zone number, "ISO".
 - .2 Addressable Input Module: Indicate Zone number, "INPUT", and device address number on loop.
 - .3 Addressable Output Module: Indicate Zone number, "OUTPUT", and device address number on loop.
- .16 Provide ground connection conductor (wire) throughout the system.
- .17 Provide necessary raceway and wiring for all listed connections and any other code required connections even if not listed herein.

- .18 Provide line isolators per NBC-2005 article 3.2.4.8 and CAN/ULC-S524-06 article 5.14. It is acceptable to modify the fire alarm riser diagram per actual site conditions if necessary provided that proper quantity of line isolators are provided at the locations required per ABC-2006 article 3.2.4.8 and CAN/ULC-S524-06 article 5.14.

3.2 SYSTEM VERIFICATION

- .1 Fire alarm equipment supplier to make a thorough inspection of the complete installed fire alarm system including all components such as manual stations, thermal detections, products-of combustion detectors, and controls to ensure the following:
- .1 System is complete and functional in accordance with engineer's specifications.
 - .2 System is installed according to CAN/ULC S524 requirements.
 - .3 System is installed in accordance with manufacturer's recommendations.
 - .4 Regulations covering supervision of components are adhered to.
 - .5 Subsequent changes necessary to conform to Items 1, 2, 3 and/or 4 to be done by Division 28 with technical assistance supplied by the manufacturer.
 - .6 During the period of this inspection by the manufacturer, supply to the manufacturer one journeyman electrician.
 - .7 To assist Division 28 in preparing his bid, manufacturer to specify number of hours required to perform this inspection.
 - .8 Manufacturer to submit to engineer on completion of inspection a point-by-point check list indicating date and time of each item inspected and also issue a Certificate for his records confirming that inspection has been completed and system is installed and functioning in accordance with the specifications. Included with this Certificate to be satisfactory- proof of liability insurance valid for not less than one (1) year from date of final inspection.
 - .9 Certificate to be free from defining and qualified statements, which would make it unacceptable by the Owner.
 - .10 Verification shall be performed by manufacturer's certified representative with contractor's assistance. Verification results shall be documented by the manufacturer's representative on the manufacturer's comprehensive fire alarm verification forms.
 - .11 System verification to be conducted in the presence of the engineer of record or his designated representative and also in presence of the owner's representative.
 - .12 Notify Engineer of verification date and time at least ten business days in advance.
 - .13 Verification may be performed only after:
 - .1 Air balancing is complete.
 - .2 Building is at a state of completion that will ensure a reasonably dust free environment and the absence of contaminating fumes from verification date to final completion.
 - .14 Manufacturer to provide sufficient backup parts on site during verification to accommodate any component failures. Backup parts not used during verification can be removed from site by the manufacturer. Recommended back-up parts list:

- .1 10 break-glass rods
- .2 5 fire detectors
- .3 1 duct detector
- .4 2 pull stations
- .5 2 horn-strobes and electronics.
- .6 1 outdoor horn.
- .7 1 outdoor strobe light and electronics
- .8 1 outdoor bell.
- .9 5 spare alarm zone cards
- .10 2 spare bell zone cards
- .11 5 appropriate sized fuses
- .12 1 CPU programming chip
- .13 Any additional parts pertinent to the particular manufacturer that may possibly fail resulting in cancellation of the verification.
- .15 Provide two fully charged hand held two-way voice communication radios during verification.
- .16 Provide all testing equipment and material required for testing smoke detectors and heat detectors during verification. Testing methods are to be as approved by manufacturer. As per CAN/ULC-S537 article 5.4.1.3, each smoke detector shall be tested to confirm that it is within its rated operating range using one of the following methods:
 - .1 Using a UL approved smoke density measurement instrument for verification of smoke detectors. Canned smoke alone is not acceptable.
 - .2 Installed control units or transponders designed to test the sensitivity of individual smoke detectors.
 - .3 Manufacturer's recommended test instrument, equipment or method. This method is acceptable only when complete official description of the manufacturer's recommended method, including the description of material, devices and equipment is submitted for Engineer's review at least four (4) weeks prior to the verification date.
 - .4 Similar for heat detectors.
- .17 Provide all testing equipment and material required for testing sound levels of the fire alarm signaling devices during verification.
- .18 Verification to be performed by the system manufacturer or it's qualified representative, certified to verify fire alarm system within the Province of British Columbia.
- .19 Fire alarm verification shall be performed during the substantial completion field review by the engineer, and witnessed by him or her. Schedule the work at the outset of the construction so that work schedules are properly coordinated to guarantee this. Coordinate with other parties involved, such as but not limited to, fire suppression systems contractor, mechanical contractor, and the Owner for setting up their contract with the remote monitoring company, to ensure completion and attendance at the time of tests.
- .20 Pretest the system prior to request for substantial completion field review and

troubleshoot all deficiencies. Submit a copy of successful pretesting report along with the request for substantial completion review.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and CAN/ULC-S537.
- .2 Fire alarm system:
 - .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, sprinkler system (flow), transmit alarm to control panel and actuate first stage alarm general alarm ancillary devices.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of trouble signals.
 - .4 Simulate and test all sprinkler valve operations, including tamper and flow switches to ensure proper annunciation on supervisory zones.
 - .5 Simulate and test all auxiliary functions.
 - .6 Simulate and test alarm and monitoring indication functions at building's control & automation panel.
 - .7 Class A Circuits:
 - .1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near mid-post point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed near mid-post point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .8 Test to be performed by the system manufacturer or qualified testing company, certified to test fire alarm system within the NWT.
 - .9 Pay for all testing costs, excluding those of the electrical consulting engineer for one time witnessing the verification. Bear all electrical consulting Engineer cost to attend more verification sessions when verification is not complete in one session. It is the contractor's responsibility to coordinate the verification and pretest the system prior to verification to minimize the efforts and cost.

3.4 TRAINING

- .1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.
- .2 Include for a minimum of 2 hours of on-site training.

3.5 OPERATION OF DACT FOR APPROVED CENTRAL STATION

- .1 Provide all necessary wiring and auxiliary relays required to connect fire alarm panel to separate channel of the DACT for alarm, supervisory and trouble conditions.
- .2 Install DACT as close as practicable to the fire alarm panel as required by CAN/ULC-S561 article 9.5.1.2.

- .3 Provide two telephone lines to the DACT.
- .4 Connect DACT to automatically transfer to secondary telephone line when primary line is faulted.
- .5 Test and verify the operation of the DACT.

3.6 LABELING

- .1 The company name and phone number of the fire alarm monitoring company and a clear statement that the equipment is being monitored and that notification must be given prior to working on or testing of the fire alarm system shall be prominently displayed on the DACT as well as the fire alarm panel, as required by CAN/ULC-S561 article 9.2.2.
- .2 When DACT transmit signals for other systems such as intrusion alarm system to the monitoring company, include all systems monitored on the same label and display the label on the control panels of other monitored systems as well.

3.7 CLEANING

- .1 Perform per section 26 05 01 Common Work results - Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Contractor to review and follow the site specific Geotechnical Report included with these Contract Documents..

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600kN-m/m³).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Product

2.1 MATERIALS

- .1 Granular material as per Section 31 05 16 - Aggregate Materials.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions:
 - .1 Examine soil report attached to these Contract Documents.
 - .2 Before commencing work establish locations of buried services on and adjacent to site.
- .2 Evaluation and Assessment:
 - .1 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.
 - .2 Testing of materials and compaction of backfill and fill is the responsibility of the Contractor.
 - .3 Not later than 1 week before backfilling or filling, provide to Departmental Representative test results completed by appropriate testing agency.s
 - .4 Not later than 48 hours before backfilling or filling with approved material, provide Departmental Representative with compaction results carried out by appropriate testing agency.
 - .5 Before commencing work, conduct, with Departmental Representative, condition survey of existing structures, trees and plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Use 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, in accordance with sediment and erosion

- control drawings.
- .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.
- .2 Protection of in-place conditions:
 - .1 Protect excavations from freezing.
 - .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's 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 to remain undisturbed.
- .3 Removal:
 - .1 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.
 - .2 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
 - .3 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.
 - .4 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
 - .5 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.

3.3 EXCAVATION

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial and Federal regulations.
- .2 Topsoil stripping:
 - .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
 - .2 Strip topsoil to depths as directed by Departmental Representative . Avoid mixing topsoil with subsoil.
 - .3 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
 - .4 Stockpile in locations as directed by Departmental Representative .
- .3 Excavate as required to carry out work, in all materials met.
 - .1 Do not disturb soil or rock below bearing surfaces. Notify Departmental Representative when excavations are complete.
 - .2 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
 - .3 Fill excavation taken below depths shown without Departmental Representative's written authorization with concrete of same strength as for footings.

- .4 Proper precautions shall be taken during excavation so as not to expose unduly the permafrost surface. Prolonged exposure of the frozen soil may result in excessive thawing and water accumulation in the excavation. Backfill operation must follow soon after the excavation is undertaken. Limit and minimize the extent of clearing to allow backfill operation to follow soon after, so as to ensure that a 150 mm minimum layer of backfill material is present at all times over excavated areas.
- .4 Excavate for slabs and paving to subgrade levels as indicated in the drawings and instructed in the attached Soils Report which indicates subexcavation to a depth of 1.0 m below (and on all sides) of the underside elevation of any new footings.
 - .1 Remove topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.4 SITE QUALITY CONTROL

- .1 Fill material and spaces to be filled to be inspected and approved by Departmental Representative.
- .2 The Contractor is solely responsible for all Quality Control and Quality Control Testing to ensure that the work is completed according to the Contract requirements.

3.5 BACKFILLING

- .1 Start backfilling only after inspection and receipt of written approval of fill material and spaces to be filled from Departmental Representative.
- .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill. Fill excavated areas with selected subgrade material compacted as specified for fill.
- .5 Placing:
 - .1 Place backfill, fill and basecourse material in 150 mm lifts. Add water as required to achieve specified density.
- .6 Compaction: unless indicated otherwise compact each layer of material to following densities for material to ASTM D698:
 - .1 To underside of basecourses: 98%.
 - .2 Basecourses: 100%.
 - .3 Elsewhere: 95%.
- .7 Under slabs and paving:
 - .1 Use 98% up to bottom of granular base courses.
 - .2 Use 100% for base courses.
- .8 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .9 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.
- .10 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter

within 600 mm of structures.

- .11 Underground tanks: use sand to bottom of granular base courses or to bottom of topsoil, as applicable.

3.6 GRADING

- .1 Grade to ensure that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Departmental Representative. Grade to be gradual between finished spot elevations as indicated.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .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 - Common Product Requirements.
- .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 Product

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 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed 5 times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
 - .2 Reclaimed asphalt pavement.
 - .3 Reclaimed concrete material.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
 - .3 Light weight aggregate, including slag and expanded shale.
 - .4 Reclaimed asphalt pavement.
 - .5 Reclaimed concrete material.

2.2 SOURCE QUALITY CONTROL

- .1 The Contractor is solely responsible for all Quality Control and Quality Control Testing to ensure that the work is completed according to the Contract requirements.
- .2 Inform Departmental Representative of proposed source of aggregates and provide sample results 2 weeks minimum before placing material.
- .3 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.
- .4 Advise Departmental Representative 2 weeks minimum in advance of proposed change of material source.
- .5 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 topsoil / organic material stripping.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with topsoil / organic material stripping. only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

3.2 PREPARATION

- .1 Topsoil / organic stripping:
 - .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
 - .2 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush and removed from site.
 - .3 Strip topsoil to depths as directed by Departmental Representative . Avoid mixing topsoil with subsoil.
 - .4 Stockpile in locations as directed by Departmental Representative . Stockpile height not to exceed 2 m.
- .2 Aggregate source preparation:
 - .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as approved by authority having jurisdiction.
 - .2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.
 - .3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
 - .4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.

- .5 Trim off and dress slopes of waste material piles and leave site in neat condition.
- .6 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.
- .3 Processing:
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.
 - .1 Use methods and equipment approved in writing by Departmental Representative.
- .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.
- .5 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.
 - .1 Use only equipment approved in writing by Departmental Representative.
- .6 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 coarse aggregate and base course materials.
 - .2 Maximum 1.5 m for fine aggregate and sub-base materials.
 - .3 Maximum 1.5 m for other 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.

3.3

CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - 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 11 - Cleaning.
- .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.
- .5 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.
- .6 Restrict public access to temporary or permanently abandoned stockpiles by means acceptable to Departmental Representative.

END OF SECTION

1. PART 1 - GENERAL

1.1. Section Includes

1.1.1. Provide site grading as specified herein.

1.2. Related Sections

1.2.1. All Sections Refer to Table of Contents

1.3. Quality Assurance

1.3.1. Be responsible for the adequate control of dust for the duration of this Contract. Such control shall be to the approval of the Departmental Representative and shall be adequate to avoid inconvenience and complaints from adjoining property, or the local authority.

2. PART 2 – PRODUCTS

2.1. Materials

2.1.1. Fill material types as per 31 23 33.01 Excavating, Trenching, and Backfilling and as per 31 05 16 Aggregate Materials.

2.1.2. Topsoil: To better or match existing.

2.1.3. Use soil treatments and procedures that are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.

3. PART 3 - EXECUTION

3.1. Examination

3.1.1. Verify site conditions.

3.1.2. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.2. Preparation

3.2.1. Identify required lines, levels, contours, and datum.

3.2.2. Utilities:

3.2.2.1. Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

3.2.2.2. Stake and flag locations of known utilities.

3.2.2.3. Protect above and below grade utilities that remain.

3.2.3. Protect plant life, lawns, and other features that are to remain, in addition to those features specifically noted to be protected for the duration of the work.

3.3. Filling

3.3.1. Fill areas to existing contours and elevations as indicated or as directed by the Departmental Representative.

3.3.2. Place fill material on continuous layers and compact.

3.3.3. Maintain optimum moisture content of fill materials to attain required compaction density.

3.3.4. Make grade changes gradual. Blend slope into level areas.

3.3.5. Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work match condition of adjacent, undisturbed areas.

3.3.6. Remove surplus fill materials from site.

3.4. Review

3.4.1. Contractor to notify Departmental Representative at least 24 hours in advance of any necessary reviews of the work.

3.5. Cleaning

3.5.1. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers above and below grade utilities that remain.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

- .1 Site Services Building and Site Services:
 - .1 Excavation, trenching, backfilling and associated works for the Site Services Building and site services shall be incidental to the Contract and will not be considered extra
- .2 Soils Remediation:
 - .1 Testpitting will be paid in accordance with unit rate price established for time to conduct testpitting during the remediation program. Includes all equipment time that may be on standby while exploratory testpitting is being conducted.
 - .2 Excavation and Stockpiling will be paid in accordance with unit rate price established for in-situ volume removed as surveyed by Departmental Representative. Volumes will be calculated using truck counts or other methods acceptable to Departmental Representative. Excavation includes onsite transport of material to a temporary stockpiling area. Includes excavator time to assist with collection of confirmatory soil samples, where necessary.
 - .3 Supply, Backfilling and Compaction (Imported Material) - Type 1 will be paid in accordance with unit rate price established for weight of Type 1 Backfill as recorded on Contractor supplied weigh scale. Includes supply (import from offsite), transport to Site, onsite transport, placing, grading and compacting, as specified in Division Number 31 23 33.01, Item 2.1.
 - .4 Supply, Backfilling and Compaction (Imported Material) - Type 2 will be paid in accordance with unit rate price established for weight of Type 2 Backfill as recorded on Contractor supplied weigh scale. Includes supply (import from offsite), transport to Site, onsite transport, placing, grading and compacting, as specified in Division Number 31 23 33.01, Item 2.1.
 - .5 Backfilling and Compaction (Re-Use Compliant Overburden - Type 3) will be paid in accordance with unit rate price established for Type 3 Backfill compacted, graded volume emplaced as surveyed by Departmental Representative. Includes re-use of suitable onsite material, transport onsite, placing, grading and compacting, as specified in Division Number 31 23 33.01, Item 2.1.
 - .6 Restoration will be paid in accordance with unit rate price established for square metre surface area restored as surveyed by Contractor's Surveyor as specified in the Drawings. Topsoil and granular soil removed during topsoil stripping may be re-used for site restoration. Includes re-vegetation of disturbed areas, including excavated area and stockpile area, with fertilizer and seed mixture appropriate for location. Measurement will not include areas unnecessarily disturbed, though these areas are required to be restored.
 - .7 Transport and Disposal of Hydrocarbon Contaminated Waste (Includes Hydrocarbon and PAH soil exceeding CCME, CWS and CSR Residential or Commercial Land Use guidelines / standards) will be paid in accordance with unit rate price established for weight identified at receiving offsite facility and approved by Departmental Representative. Transport includes loading, hauling, and unloading for all material transported from excavation area. If

- material is taken to a Treatment Facility before a Disposal Facility, payment includes transport and handling to both Treatment Facility and Disposal Facility.
- .8 Non-Contaminated Waste Disposal will be paid in accordance with unit rate price established for weight identified at receiving offsite facility, and approved by Departmental Representative. Includes loading, hauling, and unloading for all material transported from site.
 - .9 Overburden Relocation (Optional Item) will be paid in accordance with unit rate price established for insitu volume removed as surveyed by Departmental Representative. Volumes will be calculated using truck counts or other methods acceptable to Departmental Representative. Includes excavating, loading, transporting, unloading, placing Overburden soil or other material from one place on the Site to another and grading as required by the Departmental Representative.
 - .10 Highway Reinstatement (Optional Item), if required for Area 2 or 3 Remediation will be paid in accordance with unit rate price established for surface areas restored as surveyed by Contractor's Surveyor and as necessary to reinstate any part of Haines Highway or other access roads or paved areas removed as part of the remedial excavation. Includes reinstatement to applicable BC MoTI Standard Specifications for Highway Construction and the Subdivision Roads Specifications, or Yukon Government Department of Highways and Public Works requirements. Includes costs for inspection of road construction.
 - .11 Construction of Infiltration Piping (Optional Item) will be paid in accordance with lump sum price established for all necessary equipment, materials, supplies, and personnel necessary for the infiltration gallery construction, as specified in Division Number 31 23 33.01, Item 3.4.17.
 - .12 All soil quantities indicated are estimates based on available data. Actual quantities may vary.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-632002, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 INSPECTION AND TESTING

- .1 With the exception of environmental confirmatory sampling within the excavation and stockpile sampling, the Contractor will appoint and pay for the services of a testing agency or testing laboratory as specified, and where required for the following:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for the Contractor's convenience.
- .2 Contractor will organize and pay for material testing required by BC MoTI Subdivision Road Specifications and Standard Specifications for Highway Construction (Section 201 and 202), or Yukon Department of Highways and Public Works requirements.
- .3 Contractor will organize and pay for inspections required by BC MoTI Subdivision Road Specifications and Standard Specifications for Highway Construction (Section 201 and 202), or Yukon Department of Highways and Public Works requirements.
- .4 Where laboratory tests or inspections of imported fill reveal Work is not in accordance with the Contract requirements, Contractor will pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of correct Work.
- .5 Contractor will furnish labour and facilities to:
 - .1 Notify Departmental Representative in advance of planned testing.
- .6 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .7 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and reviewed for acceptance by Departmental Representative.
- .8 The Departmental Representative may require, and pay for, additional inspection and testing services not included above.
- .9 Provide Departmental Representative with 2 copies of testing laboratory reports as soon as they are available.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
 - .2 Submit for review by Departmental Representative proposed heavy prevention methods as described in PART 3 of this Section.
 - .3 Submit to Departmental Representative results 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: clearance record from utility authority.
- .4 Samples:
 - .1 Submit sample results in accordance with Section 01 33 00 - Submittal Procedures.
- .5 Temporary Hoarding: at least 5 Working Days prior to installation, Submit a description of temporary hoarding.
- .6 Excavation and Backfilling Plan: within 10 Working Days after Contract award and prior to mobilization to Site, submit documentation describing excavation plan, including:
 - .1 Excavation slopes design.
 - .2 Temporary support walls design, if required.
 - .3 Support of structures design, if required.
 - .4 Sequence, methods and means for excavation dewatering and heave protection.
 - .5 Backfilling procedures. Must meet or exceed requirements in accordance with the Contract and other codes, bylaws, rules and regulations applicable to the performance of the Work.
 - .6 Procedures for excavations adjacent to utilities or other structures if the excavation has the potential to impact utilities or other structures.
 - .7 Monitoring and inspection requirements, including frequency or milestones when a Qualified Professional to inspect Works.
 - .8 Excavation and Backfilling Plan to be signed and sealed by a Qualified Professional, as required by ground conditions, excavation depth, shoring type, or support type.
- .7 Monitoring and Testing Results: within 5 Working Days of sampling, submit all monitoring and testing results. Include procedures, frequency of sampling, Quality Assurance and Quality Control testing and documentation to be provided. Provide monitoring and testing results, including assessments performed by a Qualified Professional. Include:
 - .1 Noise monitoring.
 - .2 Vibration monitoring.
 - .3 Imported fill material, including geotechnical and environmental quality.
 - .4 Compaction testing results.
 - .5 Onsite Contaminated Wastewater Treatment Plant water testing.
 - .6 Environmental analytical results for spill or other environmental testing.
- .8 Weigh Scale Certification: at least 5 Working Days prior to use, Submit a copy of the Measurement Canada, Weigh Scale Certification for onsite or offsite weigh scale used during transportation, treatment or disposal.
- .9 Weigh Scale Slips: within 10 days of measurement, Submit all onsite and offsite weigh scale slips for material.

1.5 QUALITY ASSURANCE

- .1 The Contractor is solely responsible for all Quality Control and Quality Control Testing to ensure that the work is completed according to the Contract requirements.
- .2 Qualification Statement: submit proof of insurance coverage for professional

liability.

- .3 Where Departmental Representative is employee of Contractor, submit proof that Work by Departmental Representative is included in Contractor's insurance coverage.
- .4 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .5 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Territory of Yukon, Canada.
- .6 Keep design and supporting data on site.
- .7 Engage services of qualified professional Engineer who is registered or licensed in Territory of Yukon, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.
- .8 Do not use soil material until written report of soil test results are approved by Consultant.
- .9 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert excess aggregate materials from landfill to local recycling for reuse as directed by Departmental Representative.

1.7 EXISTING CONDITIONS

- .1 Examine soil report attached to these Contract Documents .
- .2 Buried services:
 - .1 Before commencing work establish 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 applicable authorities having jurisdiction establish location and state of use of buried utilities and structures. authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .6 Confirm locations of buried utilities by careful soil hydrovac methods or test pit methods.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered appropriate.
 - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before re-routing. Costs for such Work to be paid by Contractor .
 - .9 Record location of maintained, re-routed and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.

- .3 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 Product

2.1 MATERIALS

- .1 The following fill material types shall be utilized:
 - .1 Type 1- 75 minus well graded sand and gravel with less than 5% fines (material passing 0.075 mm sieve) compacted to at least 95% of Modified Proctor Maximum Dry Density (MPMDD) (ASTM D1557) should be used under the main building footprint of approximately 350 m². The fill shall be placed in lifts no thicker than 150 mm and placed within +/- 2% of its Optimum Moisture Content as determined by the Modified Proctor moisture-density relationship test.
 - .2 Type 2- 75 minus well graded sand and gravel with less than 8% fines compacted to at least 95% MPMDD may be used up to 0.6 m below the top of subgrade elevation under future roadways and other ancillary non-building features to be constructed on site. Lower fines-content fill is preferred for improved performance in wet and freezing weather and for simpler handling and compaction during construction. The contractor shall ensure the fill is placed in lifts no thicker than 150 mm and placed within +/- 2% of its Optimum Moisture Content as determined by the Modified Proctor moisture-density relationship test. Roadway sub-base (SGSB) or base layers (25 mm WGB) shall comply with MOTI Section 202 Table 202-C specifications. Existing sub-base and base coarse material under disturbed areas of Haines Highway can be re-used if suitable (meeting the requirements of Table 202-C).
 - .3 Type 3 - Native, non-contaminated sand and gravel may be utilized below 600 mm of the proposed subgrade elevation of proposed structures if the material complies with the gradations presented above (less than 8% fines). Native material meeting the above gradation requirements may also be used in deeper excavation backfill if it can be placed about its Optimum Moisture (+/- 2%) Content and compacted to 95% MPMDD. Cleaner native materials containing less than 5% fines, and compacted to minimum 95% of the MPMDD can be utilized as structural fill up to the subgrade elevation of the proposed structures.
 - .4 Type 3 - Native non-contaminated sand and gravel containing up to 15% fines may be utilized in general landscaping and non-structural areas where it can be placed in maximum 200 mm thick loose lifts and compacted to at least

90% of MPMDD within +/- 2% of its Optimum Moisture Content as determined by the Modified Proctor moisture-density relationship test.

- .2 All Engineered fill shall be protected from the elements so as to require minimal moisture conditioning during construction to achieve moisture contents near the Optimum Moisture Content as determined by the Modified Proctor moisture-density relationship test. All Engineered fill shall be protected from the elements so as to require minimal moisture conditioning during construction to achieve moisture contents near the Optimum Moisture Content as determined by the Modified Proctor moisture-density relationship test.

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.
- .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 REVIEW

- .1 Ensure that all Works comply with the final sealed design documents as prepared by a Qualified Professional.
- .2 Qualified Professional to visit Site regularly.

3.3 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 - Selective Site Demolition .

3.4 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures 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.

3.5 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush and removed from site.
- .2 Strip topsoil to depths as directed by Departmental Representative .

- .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative .
 - .1 Stockpile height not to exceed 2 m and should be protected from erosion.

3.6 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative.
 - .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.

3.7 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress or as directed by the Departmental Representative.
- .2 Provide to Departmental Representative details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs if necessary.
- .3 Plan for excavation below groundwater table to avoid quick conditions or heave.
- .4 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.
- .5 Protect open excavations against flooding and damage due to surface run-off.
- .6 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .7 Keep excavations, staging pads, and other Work areas free from water including standby equipment necessary to ensure continuous operation of dewatering system.
- .8 Dewatering Methods: includes sheeting and shoring; groundwater control systems; surface or free water control systems employing ditches, diversions, drains, pipes and/or pumps; and other measures necessary to enable Work to be carried out in dry conditions.
- .9 Separate Contaminated Wastewater from Non-Contaminated Wastewater and collect and divert to an onsite temporary Contaminated Wastewater Treatment Plant or offsite Contaminated Wastewater Treatment Facility as required.
- .10 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.8 EXCAVATION SLOPES

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with relevant regulations. Minimum (flattest) slope shall be 1 Vertical : 1.5 Horizontal or as directed by a geotechnical engineer.

3.9 EXCAVATION

- .1 Advise Departmental Representative at least 5 working days in advance of excavation operations.
- .2 Confirm the location of the excavation using drawings and in consultation with the Departmental Representative.
- .3 Excavate to lines, grades, elevations and dimensions as directed by Departmental Representative and as indicated in Drawings.
- .4 Depths shown are approximate and final excavation depths to be determined based on field conditions as determined by Departmental Representative.
- .5 Grade excavation top perimeter to prevent surface water run-off into excavation
- .6 Excavation must not interfere with bearing capacity of adjacent foundations.
- .7 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.
- .8 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.
- .9 Keep excavated and stockpiled materials safe distance away from edge of excavation as directed by Departmental Representative. Adhere to limits of approach in Excavation Plan
- .10 Restrict vehicle operations directly adjacent to open excavations. Adhere to limits of approach in Excavation Plan.
- .11 Segregate excavated material as follows:
 - .1 Non-Contaminated soil to be reused as backfill. Must be recommended by Contractor's Professional Engineer and accepted by Departmental Representative.
 - .2 Non-Contaminated Waste. Also includes surplus or unsuitable excavated non-contaminated soil which cannot be reused onsite.
- .12 Remove Non-Contaminated Waste.
- .13 Dispose of surplus and unsuitable excavated material in approved location on site.
- .14 Do not obstruct flow of surface drainage or natural watercourses.
- .15 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .16 Notify Departmental Representative when bottom of excavation is reached.
- .17 Obtain Departmental Representative approval of completed excavation.
- .18 Do not begin backfilling or filling operations until confirmatory sampling, analysis, and assessment has been completed by Departmental Representative. Confirmatory sampling, analysis, and assessment may take up to 5 working days. No standby charges or delays to be incurred for confirmatory sampling.
- .19 Do not begin backfilling or filling operations until surveying has been completed by Contractor's Surveyor.
 - .1 Disputed volumes will only be considered if supported by written report by a Land Surveyor registered in relevant jurisdiction at no additional cost or time.
- .20 Install infiltration gallery (Optional Item) for future delivery of activated oxygen-releasing compound as directed by Departmental Representative. Supply and install

slotted 100 mm diameter perforated PVC drain pipe at or below lowest water table depth (base of smear zone) along entire downgradient limit of final excavation. Drain pipe is to be installed level. Solid 100 mm PVC clean outs to be installed at 10 m intervals along drain pipe and completed at ground surface with steel roadbox for access. Backfill around piping with clean drain rock. Place filter cloth above drain rock to separate the overlying fill material from the drain rock.

- .21 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .22 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as indicated in the appropriate details and specifications.
- .2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILL TYPES AND COMPACTION - REMEDIATION

- .1 Use only imported backfill material in accordance with the Contract, which has been recommended by a Qualified Professional, and has previously accepted as a Submittal.
- .2 Compact material in accordance with the Contract to ensure no long term settlement and is suitable for planned post-remediation use:
 - .1 Compact to minimum 95% of correct maximum dry density
 - .2 Compaction densities are percentages of maximum densities obtained from ASTM D698 (Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
 - .3 Machine compact all fill materials unless otherwise shown on Drawings.
 - .4 In area where Haines Highway to be reinstated, compact in accordance with the BC MoTI Standard Specifications for Highway Construction (Sections 201 and 202), or Yukon Department of Highways and Public Works requirements.

3.12 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 Confirmation Sampling, analysis, and assessment has been completed by the Departmental Representative. Confirmation Sampling, analysis, and assessment may take up to 5 Working Days. No Standby Time charges or increases to Contract Amount or Extension of Time for completion of the Work can be incurred for Confirmation Sampling results provided within 5

- Working Days, not including day of sample collection.
- .4 Surveying has been completed by a Contractor's Surveyor for as-built documents.
 - .5 Departmental Representative has inspected and excavation limits accepted by the Departmental Representative based on survey data and Confirmation Samples results.
 - .6 Departmental Representative has inspected and accepted backfill material.
 - .7 Proposed backfill material can be sampled and tested for geotechnical and environmental quality. Backfill material testing may take up to 5 Working Days not including day of sample collection.
 - .8 Departmental Representative has inspected and accepted compaction results for previous lift.
 - .9 Inspection, testing, approval, and recording location of underground utilities.
 - .10 Removal of concrete formwork.
 - .11 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .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 Disputed volumes will only be considered if supported by written report by a Land Surveyor registered in relevant jurisdiction at no additional cost or time.
 - .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated or in accordance with the Contract. Compact each layer to the satisfaction of the Qualified Professional and in accordance with the Contract before placing succeeding layer.
 - .6 Backfill compaction to be tested by a Qualified Professional in accordance with Excavation Plan.
 - .7 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.50 m.
 - .4 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:
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
 - .8 Notify Departmental Representative when final backfill grade is reached.
 - .9 Place recycled fill in areas as indicated.
 - .10 Consolidate and level unshrinkable fill with internal vibrators.
 - .11 Install drainage system in backfill as directed by Departmental Representative .
 - .12 Do not begin subsequent Work until surveying has been completed by the

Departmental Representative for documentation.

3.13 RESTORATION

- .1 Upon completion of Work, remove Non-Contaminated Waste materials and debris, trim slopes, and correct defects as determined by Departmental Representative.
- .2 Grade any relocated excess Overburden as required by Departmental Representative.
- .3 Reinstall lawns and other landscaped areas to elevation which existed before excavation. Plant vegetation similar to pre-existing.
- .4 Reinstall non-landscaped areas to elevation which existed before excavation unless otherwise required by Departmental Representative.
- .5 Revegetate disturbed areas, including excavated area and stockpile area, with fertilizer and seed mixture appropriate for location. Reference current version of BC Ministry of Transportation and Infrastructure Standard Specifications for Highway Construction, Section "Revegetation Seeding". No overspray is to occur onto equipment, roadways, utilities, structures, waterbodies, or environmentally sensitive areas.
- .6 Reinstall surface grading to give Site same appearance as before remediation Work. Protect newly graded areas from traffic and erosion and maintain free of trash or debris.
- .7 Reinstall pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .8 Clean and reinstall areas affected by Work as directed by Departmental Representative.
- .9 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .10 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

3.14 HIGHWAY REINSTATEMENT

- .1 Reinstall any part of Haines Highway disturbed by excavation to thickness, structure and elevation, which existed before excavation, and in accordance with applicable BC Ministry of Transportation and Infrastructure Standard Specifications for Highway Construction, and Subdivision Road Specifications (Sections 201 and 202), or Yukon Department of Highways and Public Works requirements.
- .2 Aggregate used for road reinstatement shall be tested in accordance specifications in the BC Ministry of Transportation and Infrastructure Standard Specifications for Highway Construction (Section 202), and Subdivision Road Specifications, or Yukon Department of Highways and Public Works requirements.

3.15 TRANSPORTATION

- .1 Transport all Contaminated Waste to Treatment Facility and Disposal Facility based on Contaminated Waste type as instructed by the Departmental Representative.
- .2 Weigh material at scale certified by Measurement Canada. Submit Certification and all weigh scale receipts.
 - .1 Departmental Representative can require testing of weigh scale, or require a different weigh scale be used.

3.16 TREATMENT

- .1 Treat appropriate Contaminated Waste at Treatment Facility based on Contaminated Waste type as instructed by the Departmental Representative.
- .2 Weigh material at arrival and at departure by a scale certified by Measurement Canada. Submit Certification and all weigh scale receipts.
 - .1 Test weigh scale, or use a different weigh scale, as instructed by the Departmental Representative.

3.17

DISPOSAL

- .1 Dispose of all Contaminated Waste at Disposal Facility based on Contaminated Waste type as instructed by the Departmental Representative.
- .2 Weigh material at arrival by a scale at the Disposal Facility certified by Measurement Canada. Submit Certification and all weigh scale receipts.
- .3 Test weigh scale, or use a different weigh scale, as instructed by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Shop Drawings, Product Data and Samples
- .2 Section 03 30 00 - Cast-in-place Concrete

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 A653/A653M-10, 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-138.1-96, Fabric for Chain Link Fence.
 - .2 CAN/CGSB-138.3-96, Installation of Chain Link Fence.
 - .3 CAN/CGSB-138.4-96, Gates for Chain Link Fence.
- .3 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-08, Cementitious Materials Compendium.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data and shop drawings in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance 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 accordance with manufacturer's recommendations.
 - .2 Store and protect fence and gate materials from damage.

- .3 Replace defective or damaged materials with new.

Part 2 Product

2.1 MATERIALS

- .1 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated.
- .2 Bottom tension wire: to CAN/CGSB-138.2, single strand, galvanized steel wire.
- .3 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.
- .4 Gates: to CAN/CGSB-138.4.
- .5 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.
 - .1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.
 - .2 Fasten fence fabric to gate with twisted selvage at top.
 - .3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.
 - .4 Hardware extra heavy duty to permit 180 degree opening of gate.
 - .5 Gate to match height of fencing. refer to drawings for width.
- .6 Fittings and hardware: to CAN/CGSB-138.2, galvanized steel.
 - .1 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.
 - .2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.
 - .3 Turnbuckles to be drop forged.
 - .4 Gate Fork Latch: galvanized steel, for swing gates.
- .7 Organic zinc rich coating: to CAN/CGSB-1.181.
- .8 Padlocks and chain:
 - .1 Outdoor, heavy duty padlock c/w 38mm non-corrosive chain c/w flexible nylon cover, 1m long, for securing gates.

2.2 FINISHES

- .1 Galvanizing:
 - .1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.
 - .2 For pipe: 550 g/m²minimum to ASTM A90.
 - .3 For other fittings: to ASTM A123/A123M.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate 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 OF FENCE

- .1 Erect fence along lines as indicated and to CAN/CGSB-138.3.-M80.
- .2 Space straining posts at equal intervals not to exceed 80 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 80 m.
- .3 Install end posts at end of fence and at buildings.
 - .1 Install gate posts on both sides of gate openings.
- .4 Install overhang tops and caps.
- .5 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.
- .6 Ensure locking pins, locking nuts and gates have opposing hinge pins to increase level of security and prevention of gate removal.
- .7 Provide gate fork latch at each gate.
- .8 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

- .9 Provide outdoor padlock (keyed) c/w protected chain at each gate.

3.3 INSTALLATION OF GATES

- .1 Install gates in locations as indicated.

3.4 TOUCH UP

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas .
 - .1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

END OF SECTION

1. PART 1 - GENERAL

1.1. Section Includes

- 1.1.1. Supply and Installation of Hydraulic Seeding and related components as shown on the Drawings and as specified herein.

1.2. Related Sections

- 1.2.1. All Sections Refer to Table of Contents

1.3. Codes, References, and Standards

- 1.3.1. Canada Seed Act
- 1.3.2. British Columbia Landscape Standard, 6th edition, 2001

1.4. Quality Assurance

- 1.4.1. Scheduling:
 - 1.4.1.1. Schedule hydraulic seeding to coincide with preparation of soil surface.
 - 1.4.1.2. All seeding shall be done during calm weather and on soil that is free of frost, snow and standing water, when seasonal conditions are likely to ensure successful germination and continued growth of all species of seed in the grass mix.
 - 1.4.1.3. Schedule hydraulic seeding using grass mixtures after frost has left ground and before June 15th or between September 1st and October 15th. Note that unanticipated variances in weather may require that alternate dates be considered.

1.5. Project/Site Environmental Requirements

- 1.5.1. 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.

1.6. Delivery, Storage and Handling

- 1.6.1. Seed shall be packed and delivered in original containers clearly showing:
 - 1.6.1.1. Name of supplier
 - 1.6.1.2. Analysis of seed mixture
 - 1.6.1.3. Percentage of pure seed
 - 1.6.1.4. Year of production
 - 1.6.1.5. Net weight (mass)
 - 1.6.1.6. Date and location of bagging

2. PART 2 - PRODUCTS

- 2.1.1. Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
- 2.1.2. Grass seed for all seeded lawn areas shall meet the requirements of the Canada Seed Act for Certified Canada No. 1 Seed. Mixture composition:
 - 2.1.2.1. 30% Kentucky Bluegrass
 - 2.1.2.2. 30% Hard Fescue
 - 2.1.2.3. 40% Perennial Rye Grass

- 2.1.3. 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:
 - 2.1.3.1. Type I mulch:
 - 2.1.3.1.1. Made from wood cellulose fibre.
 - 2.1.3.1.2. Organic matter content: 95% plus or minus 0.5%.
 - 2.1.3.1.3. Value of pH: 6.0.
 - 2.1.3.1.4. Potential water absorption: 900%.
 - 2.1.3.2. Type II mulch:
 - 2.1.3.2.1. 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.
- 2.1.4. Tackifier: water soluble vegetable carbohydrate powder.
- 2.1.5. Water: free of impurities that would inhibit germination and growth.
- 2.1.6. Fertilizer:
 - 2.1.6.1. The type, formulation and rate of application of fertilizer shall be as recommended by the laboratory soil specialist on the basis of tests of the growing medium.
- 2.1.7. Inoculants: inoculant containers to be tagged with expiry date.

3. PART 3 - EXECUTION

3.1. Examination

- 3.1.1. Examine the Work and notify the Departmental Representative of any conditions affecting the performance of the Work.

3.2. Preparation

- 3.2.1. Cultivate areas identified as requiring cultivation to depth of 25 mm.
- 3.2.2. Obtain Departmental Representative's approval of grade and topsoil depth before starting to seed.

3.3. Slurry Application

- 3.3.1. Ensure seed is placed under supervision of certified Landscape Planting Supervisor.
- 3.3.2. Seed fine grade areas free of humps and hollows.
 - 3.3.2.1. Ensure areas are free of deleterious and refuse materials.
- 3.3.3. Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
 - 3.3.3.1. Using correct nozzle for application.
 - 3.3.3.2. Using hoses for surfaces difficult to reach and to control application.
- 3.3.4. Blend application 300 mm into adjacent grass areas or sodded areas to form uniform surfaces.
- 3.3.5. Immediately remove any material sprayed where not intended as directed by Departmental Representative.
- 3.3.6. Hydraulic seeding equipment:
 - 3.3.6.1. Slurry tank.
 - 3.3.6.2. 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. Capable of seeding by 50 m hand operated hoses and appropriate nozzles.

- 3.3.6.3. Tank volume to be certified by certifying authority and identified by authorities
"Volume Certification Plate"

3.4. Protection of Work

- 3.4.1. Protect seeded areas from trespass until plants are established.
3.4.2. Remove protection devices as directed by Departmental Representative.

3.5. Review

- 3.5.1. Contractor to notify Departmental Representative at least 24 hours in advance of any necessary reviews of the work.

3.6. Cleaning

- 3.6.1. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7. Maintenance During Establishment Period

- 3.7.1. Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.
3.7.2. Perform following operations from time of seed application until acceptance by Departmental Representative.
3.7.3. Grass Mixture:
3.7.3.1. Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
3.7.3.2. Mow grass to 60 mm whenever it reaches height of 100 mm. Remove clippings which will smother grass offsite.
3.7.3.3. Fertilize seeded areas after in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles; water in well.
3.7.3.4. Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
3.7.3.5. Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 MATERIALS

- .1 Concrete and Grout in accordance with Section 03 30 00 Cast-in-Place Concrete
- .2 Precast catch basin sections: to ASTM C139 suitable for H-20 loading.
- .3 Catchbasin lids: to be precast reinforced concrete designed to withstand H20 loading.
- .4 Cast iron catchbasin frame and grate: as shown on Standard Detail Drawings or as specified otherwise in Supplementary Specifications.
- .5 Joints: make watertight using cement mortar or gaskets to ASTM C443.
- .6 Mortar:
 - .1 Aggregate: to CSA A82.56.
 - .2 Cement: to CAN/CSA-A8.
- .7 Adjusting rings: to ASTM C478.

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 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 24 13 – Excavating, Trenching and Compaction and as indicated.

3.3 CONCRETE WORK

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

3.4 INSTALLATION

- .1 Install unit in accordance with details indicated, plumb and true to alignment and grade.
- .2 Set precast concrete base on 150 mm minimum of granular bedding compacted to 95% Modified Proctor density.
- .3 Install catch basin leads in accordance with CSA B181.12.
- .4 Clean unit free from of debris and foreign materials.
 - .1 Remove fins and sharp projections.
 - .2 Prevent debris from entering system.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Civil Engineers (ASCE)
 - .1 CI/ASCE 38-02, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data
- .2 British Standards Institution (BSI)
 - .1 BSI PAS 128:2014, Specification for underground utility detection, verification and location
- .3 ASTM International
 - .1 ASTM D6432-11, Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation

1.2 QUALITY ASSURANCE

- .1 Utility location surveys are to be performed in accordance with the guidelines in ASCE 38-02, PAS 128:2014, and ASTM D6432-11. This includes survey methodology, required grid spacing, equipment standards, and methods of data post-processing.
- .2 Utility locates using ground penetration radar (GPR) must be conducted by GPR operators with appropriate training and prior experience applying GPR in underground utility location surveys.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Before commencing a utility location survey using ground penetrating radar (GPR), submit the following:
 - .1 Survey type(s) to be deployed, including extents, detection methods, and any post-processing (if necessary). Comment on suitability to satisfy requirements.
 - .2 Expected achievable Quality Level and accuracy (from Table 33 65 80.1)
 - .3 Equipment to be used
 - .4 Names and experience of utility location personnel

Part 2 Products

2.1 NOT USED

- .1 Not used

Part 3 Execution

3.1 TOLERANCES

- .1 Required utility locate survey type, extents and accuracy will be indicated on the project drawings. Accuracy tolerances and Quality Level are to be as Table 33 65 80.1 (reproduced from PAS 128:2014, also in ASCE 38-02).
- .2 Table 33 65 80.1 - Quality Level of survey outputs. For more detail on each Quality Level, refer to ASCE 38-02 or PAS 128:2014.

Survey type (Establish with client prior to survey)	Quality level (Practitioner to determine post survey)	Post-processing	Location accuracy		Supporting data
			Horizontal ¹⁾	Vertical ²⁾	
D Desktop utility records search	QL-D	—	Undefined	Undefined	—
C Site reconnaissance	QL-C	—	Undefined	Undefined	A segment of utility whose location is demonstrated by visual reference to street furniture, topographical features or evidence of previous street works (reinstatement scar).
B Detection ³⁾	QL-B4	No	Undefined	Undefined	A utility segment which is suspected to exist but has not been detected and is therefore shown as an assumed route.
	QL-B3	No	±500 mm	Undefined (No reliable depth measurement possible)	Horizontal location only of the utility detected by one of the geophysical techniques used.
	QL-B3P	Yes			
	QL-B2	No	±250 mm or ±40% of detected depth whichever is greater	±40% of detected depth	Horizontal and vertical location of the utility detected by one of the geophysical techniques used. ⁴⁾
	QL-B2P	Yes			
	QL-B1	No	±150 mm or ±15% of detected depth whichever is greater	±15% of detected depth	Horizontal and vertical location of the utility detected by multiple ⁵⁾ geophysical techniques used.
QL-B1P	Yes				
A Verification	QL-A	—	±50 mm	±25 mm	Horizontal and vertical location of the top and/or bottom of the utility. Additional attribution is recorded as specified in 9.2.5.

¹⁾ Horizontal location is to the centreline of the utility.
²⁾ Vertical location is to the top of the utility.
³⁾ For detection, it is a requirement that a minimum of GPR and EML techniques are used (see 8.2.1.1.2).
⁴⁾ Electronic depth readings using EML equipment are not normally sufficient to achieve a QL-B2 or higher.
⁵⁾ Some utilities can only be detected by one of the existing detection techniques. As a consequence, such utilities cannot be classified as a QL-B1.

3.2 UTILITY LOCATION

- .1 Locate all utilities in the work area, including abandoned utilities and mark accordingly
- .2 Coordinate utility location surveys with construction activities so that all necessary utilities have been properly located in advance of construction activities

3.3 MARKINGS

- .1 Locate markings should be colour-coded in a consistent manner that matches the colour shown on the submittals
- .2 Do not perform work so far in advance that markings will be worn away by weather or site activity. Locate markings should last at least five days on any non-permanent surface (ie. grass) and at least ten days on any permanent surface (ie. pavement).
 - .1 Any re-location or re-marking of utilities will be at the Contractor's expense
- .3 Markings should be a combination of flags and ground painting as appropriate

3.4 SUBMITTALS

- .1 Marked-up plans or digital drawings showing utility segments identified along with Quality Level achieved, and which detection techniques were used in all surveyed areas of the site (including areas where no utilities have been detected)
 - .1 Colour-code utility segments consistently with field markings
 - .2 Brief description of survey outcomes. Indicate on plans any areas where detection technologies were not successful
- .2 Photographic record of field locate markings
- .3 All recorded and processed data, site notes, metadata, and intermediate stage processing files shall be retained for the duration of the project, and shall be available to the Owner or Engineer on request

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 OIL/WATER SEPARATOR

- .1 The oil/water separator shall be designed to operate under the following parameters:
 - .1 Type of Fuel: Diesel (Design S.G. \cong 0.85)
 - .2 Influent Flow: 20 L/Min. (5 USGPM), Gravity Flow
 - .3 Influent Oil Concentration: 400 PPM \leq 200 PPM solids
 - .4 Effluent Oil Concentration: 10 PPM
 - .5 Temperature Range: -30° C to 30° C
 - .6 Minimum Spill Volume: 1,000 Litres.
- .2 The oil/water separator shall be liquid-tight to prevent either ingress or egress of liquids.
- .3 The oil/water separator shall be constructed of materials compatible with Diesel.
- .4 Pre-cast reinforced concrete oil/water separator chamber complete with coalescing plates to meet the operating parameters above, c/w 3 steel baffles, heat tracing, interior concrete waterproofing coating, exterior black tar emulsion and mastic sealant. Chamber cover shall be removable checker plate, rated for H2O traffic loading.

2.2 UNDERGROUND PVC PIPING AND FITTINGS

- .1 Pipe: PVC/DWV pipe, certified to CSA B 181.2 with solvent-weld connections or Schedule 80 fittings as noted on drawings.
- .2 Flanges: 100Ø (4") PVC Schedule 80, 150# Vanstone Flange with solvent-weld socket connection.

- .3 Valves: 100Ø (4") Butterfly Valve with polypropylene disc, Viton liners and seals.

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 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 24 13 – Excavating, Trenching and Compaction and as indicated.

3.3 INSTALLATION

- .1 Oil/Water Separator:
- .1 Install level on both axes.
 - .2 Backfill as shown on drawings.
 - .3 Fill with clean water to “prime” system.
- .2 PVC Drainage Piping:
- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction and to following standards except where specified otherwise.
 - .2 PVC drainage piping shall be installed in accordance with the manufacturer’s instructions. Completed piping shall be air tested, prior to backfilling, in accordance with the “IPEX PVC Sewer Pipe Installation Guide”

END OF SECTION