



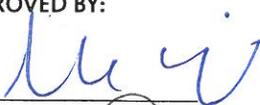
Public Works and Government Services Canada

Requisition No. EZ 899.16 0614

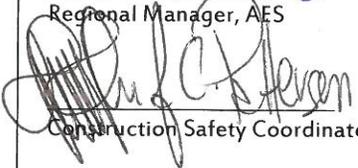
SPECIFICATIONS
for
PENTICTON AIRPORT SANITARY LIFT STATION REPLACEMENT
PENTICTON, B.C.

Project No. R. 070315.001
June 2015

APPROVED BY:


Regional Manager, AES

2015-06-29
Date


Construction Safety Coordinator

2015-06-18
Date

TENDER:


Project Manager

2015-06-03
Date

 SPECIFICATIONS

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33 34 00	Sanitary Utility Sewerage Force Mains	6 pages

DRAWINGS **Bound Separately**

General

C0	Cover Sheet / Location Plan & Drawing Index
C1	Key Plan, Site Plan and Legend

Civil

C2	Sanitary Sewer Plan & Profiles
C3	Sanitary Lift Station Details
C4	Flow Meter & Air Valve Chamber, Kiosk & Genset Bases and Miscellaneous Details
C5	Watermain and Fence Details

Structural

S1 Lift Station and Kiosk & Genset Pad Details and Sections

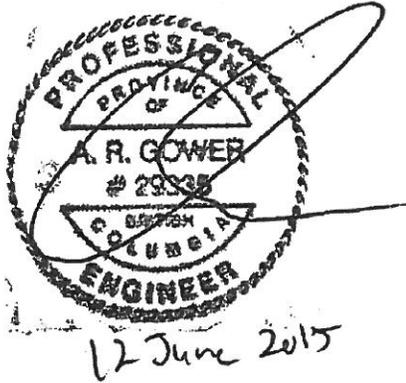
Electrical

E1 Site Plan / System One Drawing
E2 Kiosk Details
E3 Kiosk Details
E4 Control Panel Details
E5 Radio Antenna and Lighting Details

APPENDICES

A	Geotechnical Assessment Report	17 pages
B	Pre-Construction Hazard Assessment	4 pages

END OF INDEX

DISCIPLINE	SEAL
PRIME CONSULTANT CIVIL ENGINEER	 <p>A circular professional engineer seal for A. R. Gower, #29338, British Columbia. The seal is stamped with the text "PROFESSIONAL PROVINCE OF BRITISH COLUMBIA ENGINEER". A handwritten signature "A. R. Gower" is written over the seal, and the date "12 June 2015" is written below it.</p>
STRUCTURAL ENGINEER	 <p>A circular professional engineer seal for B. A. West, #22495, British Columbia. The seal is stamped with the text "PROFESSIONAL PROVINCE OF BRITISH COLUMBIA ENGINEER". A handwritten signature "B. A. West" is written over the seal, and the date "05/06/12" is written below it.</p>
ELECTRICAL ENGINEER	 <p>A circular professional engineer seal for B. C. Muir, #31323, British Columbia. The seal is stamped with the text "PROFESSIONAL PROVINCE OF BRITISH COLUMBIA ENGINEER". A handwritten signature "B. C. Muir" is written over the seal, and the date "2015-06-12" is written below it.</p>

END OF SECTION

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|---|-----------|---|
| <p>1.5 <u>Required Documents</u></p> | <p>.1</p> | <p>Maintain one copy at job site:</p> <ul style="list-style-type: none"> .1 Contract drawings, Safety Plan and Waste Reduction Workplan. .2 Specifications. .3 Addenda .4 Change orders .5 Other modifications to contract .6 Copy of approved work schedule .7 Health and Safety plan. .8 Environmental Emergency Response Plan (including Spill Response Plan) |
| <p>1.6 <u>Drawings</u></p> | <p>.1</p> | <p>Contract Drawings:</p> <ul style="list-style-type: none"> .1 Following contract award, four (4) full size sets of the drawings will be provided. <p>.2 Record Drawings:</p> <ul style="list-style-type: none"> .1 Two sets of drawings and specifications will be provided for as-built purposes. Maintain accurate records on one set. At Substantial Completion, transfer all notations to the other set and submit it to the Department Representative. .2 Production of CAD Record Drawings not included within Contract. |
| <p>1.7 <u>Site Condition</u></p> | <p>.1</p> | <p>Make inquiries or investigations necessary to become thoroughly acquainted with site, soil, surface, stream and road access conditions, and the nature and extent of the work.</p> <p>.2 Submission of a tender will be deemed confirmation that the Contractor is acquainted with the site and is conversant with all relevant conditions.</p> |
| <p>1.8 <u>Ground Condition Data</u></p> | <p>.1</p> | <p>The Departmental Representative has no detailed ground condition data for this site.</p> <p>.2 See Appendix A for the relevant Geotechnical Assessment Report.</p> |

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| <p>1.9 <u>Layout of Work</u></p> | <p>.1
.2
.3</p> | <p>Construction layout is the responsibility of Contractor.</p> <p>Point Files and survey data will be made available by the Departmental Representative.</p> <p>Notify Departmental Representative immediately if the work cannot be completed as shown in the plans and specifications.</p> |
| <p>1.10 <u>Sequencing of Work</u></p> | <p>.1
.1
.2
.2
.3</p> | <p>Within 15 days of Contract award, Contractor to submit to the Department Representative for approval a plan clearly indicating proposed sequencing of Work.</p> <p>.1 Include documents submittals warning Department Representative of forthcoming activities.</p> <p>.2 Refer to Contact Drawings for recommended sequencing.</p> <p>.2 Sequencing to ensure that full sanitary and water service is maintained to all areas affected by the Work throughout the duration of the project.</p> <p>.3 Whenever a variation from the schedule in excess of 5 working days occurs or is expected to occur, request approval from Departmental Representative for the change in writing.</p> |
| <p>1.11 <u>Assistance by the Contractor</u></p> | <p>.1</p> | <p>Provide access to the work areas as required for the Departmental Representative to perform their duties.</p> |
| <p>1.12 <u>Time of Completion</u></p> | <p>.1</p> | <p>Complete all work, including all required submittals, under the contract within fourteen (14) weeks of award.</p> |
| <p>1.13 <u>Use of Site</u></p> | <p>.1
.2
.1
.2</p> | <p>Use of site is limited to work areas required for the work, including the storage of materials and equipment and to the access routes assigned by the Departmental Representative required for the completion of work as specified. Access keys will be provided to the contractor as required.</p> <p>Hours of work to comply with local bylaws.</p> <p>.1 Perform work during normal hours, Monday to Friday, except holidays.</p> <p>.2 Work may be performed after working hours, on weekends and holidays as approved by Departmental Representative.</p> |

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- 1.15 Project Meetings .1 The Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
- .2 Accommodations to be made to have a City of Penticton representative attend all planning and construction meetings.
- 1.16 Location of Equipment and Fixtures .1 Location of existing equipment and fixtures indicated or specified is to be considered as approximate.
- 1.17 Inspection Services .1 Inspections will be carried out by Departmental Representative.
- .2 Where inspections reveal that work is not in accordance with the contract requirements, additional inspections to confirm acceptability of the corrected work will be conducted at the expense of the Contractor.
- 1.18 Interpretation .1 In interpreting the Contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.
- .2 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between:
- .1 The Plans and Specifications, the Specifications govern;
 - .2 The Plans, the Plans drawn with the largest scale govern; and
 - .3 Figured dimensions and scaled dimensions, the figured dimensions govern.
- 1.19 Safe Companies Certification .1 The Contractor must ensure that all works are performed by contractors who are one of the following:
- .1 Have current WCB registration and clearance;
 - .2 Have required WHIMIS training;

END OF SECTION

PART 1 - GENERAL

1.1 Administrative

- .1 Submit to Departmental Representative submittals listed under each Section 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.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock ups in SI Metric units.
- .4 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.
- .5 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Verify field measurements and affected adjacent Work are co-ordinated.
- .7 The review of the Environmental Emergency Response Plan by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.2 Submittals

- .1 Allow 5 days for Departmental Representative's review of each submission.
- .2 Adjustments made to submitted plans 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.
- .3 Make changes to submitted plan as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .4 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.
- .5 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.
- .6 After Departmental Representative’s review, distribute copies.
- .6 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, Work may proceed. If submitted plan is rejected, noted copy will be returned and resubmission of corrected plan, through same procedure indicated above, must be performed before Work may proceed.
- .7 All submissions to be made electronically in Adobe Acrobat “.PDF” format.

1.3 Certificates and Transcripts

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.

1.4 Shop Drawings

- .1 Shop drawings: original drawings or modified standard drawings provided by Contractor to illustrate details of portions of work which are specific to project requirements and/or as requested by the Department Representative.
 - .1 Format, as directed by the Department Representative
 - .1 Electronically in Adobe Acrobat “.PDF” format.
 - .2 6 prints, maximum size: 850 x 1050 mm.
 - .2 Cross-reference shop drawing information to applicable portions of the Contract documents.

1.5 Shop Drawings Review

- .1 Review of shop drawings by Department Representative is for the

sole purpose of ascertaining conformance with the general concept.

- .2 This review shall not mean that the Department Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same.
- .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 the generality of the foregoing, the Contractor is responsible for:
 - .1 Dimensions to be confirmed and correlated at the job site.
 - .2 Information that pertains solely to the fabrication processes or to techniques of construction and installation.
 - .3 Coordination of the work of all the sub-trades.

1.6 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.
- .5 Submit electronic PDF copies of product data.

1.7 Samples

- .1 Samples: examples of materials, equipment, quality, finishes and workmanship.
- .2 Reviewed and accepted samples will become the standard of workmanship and material against which installed work will be verified.

END OF SECTION

PART 1 - GENERAL

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| 1.1 | Related Sections | .1 | Section 01 11 05 – General Instructions. |
| | | .2 | Section 01 35 33 – Health and Safety Requirements. |
| | | .3 | Section 02 41 99 – Demolition for Minor Works. |
| | | .4 | Section 31 00 99 – Earthworks for Minor Works. |
| | | .5 | Section 32 12 16.02 – Asphalt Paving for Building Sites. |
| 1.2 | Reference | .1 | Transportation Association of Canada. |
| | | .1 | Transportation Manual of Uniform Traffic Control Devices for Streets and Highways for Canada. |
| | | .2 | British Columbia Ministry of Transportation. |
| | | .1 | Traffic Control Manual for Work on Roadways. |
| 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 | When working on travelled way: |
| | | .1 | Place equipment in position to present minimum of 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. |
| | | .3 | Do not close any lanes of road without prior approval of Department Representative. Before re-routing traffic, erect suitable signs and devices in accordance with manuals referenced in Part 1.2. |
| | | .4 | Keep travelled way graded, free of pot holes and of sufficient width for required number of lanes of traffic. |
| | | .5 | Keep travelled way graded, free of pot holes and of sufficient width for required number if lanes of traffic. |
| | | .1 | Provide minimum 7 m wide temporary roadway for traffic in two-way sections through Work and on detours. |
| | | .2 | Provide minimum 5 m wide temporary roadway for traffic in |

one-way sections through Work and on detours.

- .6 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, unless other means of road access exist that meet approval of Departmental Representative.

1.4 Information and Warning Devices

- .1 Provide and maintain signs, 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 in accordance with manuals referenced in Part 1.2.
- .3 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.
- .4 Continually maintain traffic control devices in use by:
 - .1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Removing or covering signs which do not apply to conditions existing from day to day.

1.5 Control of Public Traffic

- .1 Provide competent flag persons, trained in accordance with, and properly equipped as specified in manuals referenced in Part 1.2, in following situations:
 - .1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.
 - .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
 - .3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate

warning.

- .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
- .5 For emergency protection when other traffic control devices are not readily available.
- .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
- .7 At each end of restricted sections where pilot cars are required.
- .8 Delays to public traffic due to contractor's operators: maximum 15 minutes.
- .2 Equip pilot cars (if required) with orange flashing lights and signs clearly designating vehicles as pilot cars.
- .3 Where roadway, carrying two-way traffic, is restricted to one lane, for 24 hours each day, provide portable traffic signal system. Adjust, as necessary, and regularly maintain system during period of restriction. Signal system to meet requirements of manuals referenced in Part 1.2.

PART 2 - PRODUCTS

2.1 Not Used	.1	Not Used.
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PART 3 - EXECUTION

3.1 Not Used	.1	Not Used.
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END OF SECTION

- 1.1 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 Province of British Columbia:
 - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulation

- 1.2 Related Sections
 - .1 Refer to the following sections as required:
 - .1 General Instructions: Section 01 11 05
 - .2 Demolition for Minor Works: Section 02 41 99
 - .3 Asbestos Abatement: Section 02 82 00.02
 - .4 Earthworks for Minor Works: Section 31 00 99

- 1.3 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.

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| <p>1.4 Compliance with Regulations</p> <hr/> | <p>1</p> | <p>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.</p> |
| | <p>.2</p> | <p>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.</p> |
| <p>1.5 Submittals</p> <hr/> | <p>.1</p> | <p>Submit to Departmental Representative submittals listed for review in accordance with Section 01 33 00 – Submittal Procedures.</p> |
| | <p>.2</p> | <p>Work effected by submittal shall not proceed until review is complete.</p> |
| | <p>.3</p> | <p>Submit the following:</p> |
| | <p>.1</p> | <p>Health and Safety Plan.</p> |
| | <p>.2</p> | <p>Copies of reports or directions issued by Federal and Provincial health and safety inspectors.</p> |
| | <p>.3</p> | <p>Copies of incident and accident reports.</p> |
| | <p>.4</p> | <p>Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.</p> |
| | <p>.5</p> | <p>Emergency Procedures.</p> |
| | <p>.4</p> | <p>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.</p> |
| | <p>.5</p> | <p>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.</p> |

- .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.

1.6 Responsibility

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .3 The Contractor is to assume the role of the “prime contractor” for the duration of the job

1.7 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.

1.8 Project/ Site Conditions

- .1 Work at site will involve contact with:
 - .1 Unknown buried utilities and infrastructure.
 - .2 Buried asbestos pipe.
 - .3 Mercury containing switches.

- .4 Lead paint (possibly).
 - .5 Pipes under pressure.
 - .6 Excavations.
 - .7 Heavy machinery (if necessary).
 - .8 Live electrical equipment.
- 1.9 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.
- 1.10 Filing of Notice
- .1 The Contractor is to complete and submit a Notice of Project as required by Provincial authorities.
 - .2 Provide copies of all notices to the Departmental Representative.
- 1.11 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.

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- 1.12 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 and site staff.
 - .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.
 - .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.

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| 1.13 | <u>Hazardous Products</u> | .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: <ul style="list-style-type: none"> .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00. .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 01 51 00. |
| 1.14 | <u>Fire Safety Requirements</u> | .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. |
| 1.15 | <u>Unforeseen Hazards</u> | .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. |
| 1.16 | <u>Posted Documents</u> | .1 | Post legible versions of the following documents on site: <ul style="list-style-type: none"> .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.

1.17 Meetings

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.18. 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".

END OF SECTION

PART 1 - GENERAL

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|-----|-------------------------------|----|---|
| 1.1 | Environmental
Factors | .1 | Ensure that operations meet all applicable environmental regulations and standards. |
| | | .2 | Ensure no storm water runoff from the site of a deleterious nature is released into any storm sewers or water courses. |
| 1.2 | Disposal of
Wastes | .1 | Do not bury rubbish on site. |
| 1.3 | Fires | .1 | Fires and burning on site is not permitted. |
| 1.4 | Work Adjacent to
Waterways | .1 | Do not operate construction equipment in waterways. |
| | | .2 | Do not dump any waste material or debris in waterways. |
| 1.5 | Pollution Control | .1 | Ensure all equipment is in proper working order. |
| | | .2 | Control emissions from equipment to local authorities' emission requirements. |
| | | .3 | Spill kits and containment materials must be maintained on-site and ready for deployment in case of spills. |
| | | .1 | Spills kits are to contain sufficient quantities of absorbent material on site in close proximity to working machinery. |
| | | .2 | During the work, there is to be trained and qualified personnel on site that ready to deploy spill kits when necessary. |

- 1.6 Submittals
- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Submit an Environmental Emergency Response Plan, including spill response plan, to Department Representative for approval.

PART 2 - EXECUTION

- 2.1 Work Procedures
- .1 Prior to the start of the work, the Environmental Response Plan is to be submitted to the Departmental Representative as note in Section 01 33 00.
 - .2 Work on site will be conducted in accordance with the plans and specifications, the Environmental Response Plan and all other applicable regulations.

END OF SECTION

1.1	Sections Include	.1	Inspection and testing, administrative and enforcement requirements.
		.2	Equipment and system adjust and balance.
1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 78 00 – Closeout Submittals
1.3	Inspection	.1	Allow the Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
		.2	Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by the Departmental Representative instructions, or law of Place of Work.
		.3	If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
		.4	Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.
1.4	Independent Inspection Agencies	.1	Independent Inspection/ Testing Agencies will be engaged by the Departmental Representative for purpose of inspecting and/ or testing portions of Work. Cost of such services will be borne by Departmental Representative.
		.2	Provide equipment required for executing inspection and testing by appointed agencies.
		.3	Employment of inspection/ testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
		.4	If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain

			full degree of defect. Correct defect and irregularities as advised by the Departmental Representative at no cost to the Departmental Representative. Pay costs for retesting and reinspection.
1.5	Access to Work	.1	Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
		.2	Co-operate to provide reasonable facilities for such access.
1.6	Procedure	.1	Notify appropriate agency and the Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
		.2	Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
		.3	Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.
1.7	Rejected Work	.1	Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the 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 the Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by the Departmental Representative.
1.8	Reports	.1	Submit inspection and test reports to the Departmental Representative in accordance with Section 01 33 00.

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|-----|--------------------------|----|--|
| 1.9 | Equipment and
Systems | .1 | Submit adjustment and balancing reports for mechanical, electrical and building equipment systems. |
| | | .2 | Mechanical – coordinate with mechanical division. |
| | | .3 | Electrical – Coordinate with electrical division. |

END OF SECTION

PART 1 - GENERAL

1.1	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 35 43 – Environmental Procedures.
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1.2	Submittals	.1	Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
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1.3	Installation and Removal	.1	Provide temporary utilities controls and trailers necessary in order to execute work expeditiously.
		.2	Remove from site all such work after use.
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1.4	Dewatering	.1	Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
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1.5	Water Supply	.1	Potable water for construction use will not be provided by PWGSC.
		.2	Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
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1.6	Temporary Communication Facilities	.1	Provide and pay for any temporary telephone, fax, data hook up, lines, and equipment necessary for own use.
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1.7	Fire Protection	.1	Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.
		.2	Burning rubbish and construction waste materials is not permitted on site.
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1.8	Sanitary Facilities	.1	Provide, pay, and maintain for sanitary facilities for the duration of the work.

PART 2 - EXECUTION

2.1 Temporary
Erosion and
Sedimentation
Control

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

PART 1 - GENERAL

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|-----|------------------------|----|--|
| 1.1 | Waste Management Goals | .1 | Prior to start of Work, submit for approval a written Waste Management plan to the Department Representative. Approval must be obtained prior to beginning onsite work. |
| | | .2 | Accomplish maximum control of solid construction waste. |
| | | .3 | Preserve environment and prevent pollution and environment damage. |
| 1.2 | Related Sections | .1 | Section 03 30 00 – Cast in place Concrete. |
| | | .2 | Section 26 05 00 – Common Work Requirement-Electrical. |
| | | .3 | Section 26 29 03 – Control Devices. |
| | | .4 | Section 26 32 13.01 – Power Generation Diesel. |
| | | .5 | Section 02 82 00.02 – Asbestos Abatement. |
| | | .6 | Section 31 32 19.01 – Geotextiles |
| | | .7 | Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type |
| | | .8 | Section 33 31 13 – Public Sanitary Utility Sewerage Piping |
| | | .9 | Section 33 34 00 – Sanitary Utility Sewerage Force Mains |
| 1.3 | Definitions | .1 | Inert Fill: inert waste – exclusively asphalt and concrete. |
| | | .2 | Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation. |
| | | .3 | Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse. |
| | | .4 | Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products. |
| | | .5 | 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.

- .6 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.
- .7 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .8 Separate Condition: refers to waste sorted into individual types.
- .9 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .10 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. Refer to Schedule A.
- .11 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (schedule A).

1.4 Documents

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Audit
 - .2 Waste Reduction Workplan
 - .3 Material Source Separation Plan.
 - .4 Schedules A & B completed for project

1.5 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 Waste Audit (WA): Schedule A.
 - .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
 - .3 Submit 2 copies of Materials Source Separation Program (MSSP) description.

- 1.6 Waste Audit (WA)
 - .1 Conduct WA prior to project start-up.
 - .2 Prepare WA: Schedule A.
 - .3 Record, on WA – Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

- 1.7 Waste Reduction Workplan (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.
- 1.8 Materials Source Separation Program (MSSP)
 - .1 Prepare MSSP and have ready for use prior to project start-up.
 - .2 Implement MSSP for waste generated on project in compliance with approved methods as reviewed by Departmental Representative.
 - .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
 - .4 Provide containers to deposit reusable and recyclable materials.
 - .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
 - .6 Locate separated material[s] in area[s] which minimize material damage.
 - .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility.
- 1.9 Storage, Handling And Protection
 - .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
 - .2 Unless specified otherwise, materials for removal become Contractor’s property.
 - .3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
 - .4 Protect structural components not removed for demolition from movement or damage.
 - .5 Protect surface drainage, mechanical and electrical from damage and blockage.
 - .6 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 Provide waybills for separated materials.

- 1.10 Disposal Of Wastes
 - .1 Do not bury rubbish or waste materials.
 - .2 Do not dispose of waste 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.

- 1.11 Use Of Site And Facilities
 - .1 Execute work with least possible interference or disturbance to normal use of premises.
 - .2 Maintain security measures established by existing facility.

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

- 1.13 Application
 - .1 Do Work in compliance with WRW.
 - .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

- 1.14 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.

1.15 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 materials IS NOT permitted.
- .3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

.4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		

1.17 Waste Reduction .1 Schedule B.
 Workplan

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected Actual	(5) Recycled Amount (unit) Project Actual	(6) Material Destination
Wood and Plastics Material Description					
Chutes					
Warped Pallet Forms					
Plastic Packaging					
Cardboard Packaging					
Wood					
Metal					
Other					

END OF SECTION

1.1	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 78 00 – Closeout Submittals.
<hr/>			
1.2	References		Not Applicable
<hr/>			
1.3	Substantial Completion Inspection and Declaration Procedures	.1	Acceptance of Work Procedures:
		.1	Notify the Departmental Representative in writing of satisfactory completion claim and request the Departmental Representative’s inspection. A minimum of 7 days notice is required.
		.2	Department Representative will complete an inspection and prepare a list of deficiencies and/or outstanding work.
		.2	Completion Tasks: submit written certificates in English that deficiency tasks have been performed as follows:
		.1	Work: completed and inspected for compliance with Contract Documents.
		.2	Defects: corrected and deficiencies completed.
		.3	Operation of systems: demonstrated to required personnel.
		.4	Work: complete and ready for Final Inspection.
		.3	Final Inspection:
		.1	When completion tasks are done, request final inspection of Work by the Departmental Representative, and Contractor.
		.2	When Work incomplete according to Departmental Representative.
		.1	Complete outstanding items and request re-inspection.
		.2	Incur all costs for re-inspection, including travel time for Department Representative.
		.3	Declaration of Substantial Performance: when the Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

- 1.4 Final Cleaning
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
 - .2 Work site landscaping to be reinstated to pre-existing conditions or better.
 - .3 Waste Management: separate waste materials for reuse and recycling.

- 1.5 Total Performance Inspection and Declaration Procedures
 - .1 Acceptance of Work Procedures:
 - .1 Notify the Departmental Representative in writing of satisfactory completion claim and request the Departmental Representative's inspection.
 - .2 Department Representative will complete an inspection and prepare a list of deficiencies and/or outstanding work.
 - .2 Completion Tasks: submit written certificates in English that deficiency tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by the Departmental Representative, and Contractor.
 - .2 When Work incomplete according to Departmental Representative.
 - .1 Complete outstanding items and request re-inspection.
 - .2 Incur all costs for re-inspection, including travel time for Department Representative.
 - .3 Declaration of Total Performance: when the Departmental Representative considers deficiencies and defects corrected and requirements of Contract totally performed.

END OF SECTION

PART 1 - GENERAL

1.1	Related Requirements	.1	26 05 00 – Common Work Requirement – Electrical
		.2	26 29 03 – Control Devices
		.3	26 32 13.01 – Power Generation Diesel
		.4	26 36 23 – Automatic Transfer Switches
		.5	32 31 13 – Chain Link Fences and Gates
		.6	32 32 13.13 – Packaged Sewage Lift, Wet Well Type
		.7	32 92 19.16 – Hydraulic Seeding
		.8	33 11 16 – Site Water Utility Distribution Piping
		.9	33 31 13 – Public Sanitary Utility Sewerage Piping
		.10	33 34 00 – Sewerage Force Mains
1.2	Action and Informational Submittals	.1	Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
		.2	Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.
		.3	Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
		.4	Provide evidence, if requested, for type, source and quality of products supplied.
1.3	Format	.1	Organize data as instructional manual.
		.2	Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
		.3	When multiple binders are used correlate data into related consistent groupings.
		.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 (i.e. utilities, controls) 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.
	.9	Provide Record Drawings and Final Survey data.
1.4	Contents – Project Record Documents	.1
		.1
		.2
		.3
		.2
		.1
		.3
		.4
		.5
		.1
1.5	As Built Documents And Samples	.1
		.1

- .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
 - .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
 - .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
 - .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
 - .5 Keep record documents and samples available for inspection by Departmental Representative.
- 1.6 Recording Information On Project Record Documents
-
- .1 Record information on set of black line opaque drawings, provided by Departmental Representative.
 - .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
 - .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
 - .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to geodetic datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

- .3 Field changes of dimension and detail.
- .4 Changes made by change orders.
- .5 Details not on original Contract Drawings.
- .6 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.
- .7 Provide digital photos for site records.

1.7 Final Survey

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

1.8 Equipment And Systems

- .1 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.
- .2 Maintenance Requirements: include routine procedures and guide for trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .3 Include manufacturer's printed operation and maintenance instructions.
- .4 Provide original manufacturer's parts list, illustrations, assembly

			drawings, and diagrams required for maintenance.
	.5		Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
	.6		Additional requirements: as specified in individual specification sections.
1.9		.1	Spare Parts:
Maintenance		.1	Provide spare parts, in quantities specified in individual specification sections.
Materials		.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.
1.10		.1	Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
Delivery, Storage		.2	Store in original and undamaged condition with manufacturer's seal and labels intact.
And Handling		.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.

- 1.11 Warranties And Bonds
 - - .1 Develop warranty management plan to contain information relevant to Warranties.
 - .2 Submit warranty management plan, 15 days before planned Substantial Completion, to Departmental Representative.
 - .3 Warranty management plan to include required actions and documents to assure that the Departmental Representative receives warranties to which it is entitled.
 - .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
 - .5 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
 - .6 Conduct joint 12 month warranty inspection, measured from time of acceptance, by Departmental Representative.

- .7 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .3 Contractor's plans for attendance at 12 month

post-construction warranty inspections.

.4 Procedure and status of tagging of equipment covered by extended warranties.

.5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/ or safety reasons.

.8 Respond in timely manner to oral or written notification of required construction warranty repair work.

1.12 Warranty Tags

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

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

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|------|-----------------------------|----|--|
| 1.1 | Related Requirements | .1 | Refer to the following sections regarding system tests that are also to be used for demonstration purposes |
| | | .1 | Section 01 91 00 – General Commissioning Requirements. |
| | | .2 | Section 26 05 00 – Common Work Requirement-Electrical. |
| | | .3 | Section 26 29 03 – Control Devices. |
| | | .4 | Section 26 32 13.01 – Power Generation Diesel. |
| | | .5 | Section 26 36 23 – Automatic Transfer Switches. |
| | | .6 | Section 32 32 13.13 – Packaged Sewage Lift-Wet Well Type. |
|
 | | | |
| 1.2 | Administrative Requirements | .1 | Demonstrate operation and maintenance of equipment and systems to Departmental Representative prior to date of final inspection. |
| | | .2 | Departmental Representative to provide list of personnel to receive instructions, and co-ordinate their attendance at agreed upon times. |
| | | .3 | Preparation: |
| | | .1 | Verify conditions for demonstration and instructions comply with requirements. |
| | | .2 | Verify designated personnel are present. |
| | | .3 | Ensure equipment has been inspected and put into operation in accordance with Manufacturer’s Recommendations, Contract Specifications, City of Penticton Bylaws, and to the satisfaction of the Department Representative. |
| | | .4 | Ensure testing, adjusting, and balancing has been performed as required and that equipment and systems are fully operational. |
| | | .4 | Demonstration and Instructions: |
| | | .1 | Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location. |
| | | .2 | Instruct personnel in phases of operation and maintenance |

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- using operation and maintenance manuals as basis of instruction.
- .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- 1.3 Action and Informational Submittals
-
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
 - .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
 - .4 Give time and date of each demonstration, with list of persons present.
 - .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 01 79 00 – Demonstration and Training.
- .2 Section 26 05 00 – Common Work Requirement-Electrical.
- .3 Section 26 29 03 – Control Devices.
- .4 Section 26 32 13.01 – Power Generation Diesel.
- .5 Section 26 36 23 – Automatic Transfer Switches.
- .6 Section 32 32 13.13 – Packaged Sewage Lift-Wet Well Type.

1.2 General Requirements

- .1 Provide all necessary trades to carry out the commissioning of systems in accordance with this Section and as directed by the Departmental Representative’s appointed Certified Commissioning Agent.
- .2 Carry out additional tests as required to verify the proper operation of each piece of equipment and each system.
- .3 Coordinate with the Departmental Representative’s appointed Commissioning Agent throughout the commissioning of the equipment and systems specified under this contract.
- .4 The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Departmental Representative, to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- .5 The Commissioning Agent will perform inspections to ensure completeness of systems. The agent will advise the contractor of equipment and system deficiencies using a work sheet that is updated regularly. Where immediate action is required on a deficiency or problem the agent will deliver a memo with the necessary information to the contractor.
- .6 The items noted on the daily work sheet are specific to the commissioning process and are for the use of the mechanical and electrical contractors and sub-trades.
- .7 The mechanical and electrical contractors shall advise the Commissioning Agent of any material supply problems or performance delays at the earliest opportunity.
- .8 The Commissioning Agent will hold regular meetings prior to and during the commissioning period. The design authority and named contractors will appoint commissioning representatives. They will attend the meetings and take action on the recommendations as noted in the minutes.

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- .9 The activities of the Commissioning Team do not relieve the Contractor of their requirement to supply manpower as required to operate equipment and systems to permit safe completion of commissioning activities. Where possible they should attempt to coordinate their activities with the commissioning requirements to make the best use of time.
-
- 1.3 Commissioning Team

 - .1 The Commissioning Team is to be developed as directed by the designated Commissioning Agent. At a minimum, it is recommended that the Commissioning Team be comprised of:
 - .1 Certified Commissioning Agent.
 - .2 General Contractor.
 - .3 Departmental Representative.
 - .4 Prime Consultant.
 - .5 Division 23 Trades.
 - .6 Division 26 Trades.
 - .7 Division 32 Trades.
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- 1.4 Submittals

 - .1 Submit a schedule and checklist for the commissioning phase of work in accordance with Section 01 33 00 – Submittal Procedures. This schedule shall show:
 - .1 Completions dates for each trade.
 - .2 Timing of the various phases of the commissioning, testing, balancing, and demonstration process.
 - .1 Phase 1 – System Readiness.
 - .2 Phase 2 – System Start-Up, Testing, Balancing.
 - .3 Phase 3 – Verification of System Commissioning.
 - .4 Phase 4 – Demonstration and Training.
 - .5 Each Phase is applicable to each major and/or separate system making up the Work.
 - .3 The name and contact information of the responsible person in each trade.
 - .4 Submission dates for the various documents required prior to substantial performance.
-
- 1.5 Personnel

 - .1 Assign a person to act as a direct point of contact with the Commissioning Agent (the Commissioning Representative).
 - .1 To be fully qualified through practical experience and have a comprehensive knowledge of the interactive nature of the installed systems and their controls.

- 1.6 Training .1 Provide for training in accordance with Section 01 79 00 – Demonstration and Training.

- 1.7 Additional Laboratory Tests .1 Should field tests indicate that equipment supplied to the project does not meet specifications, laboratory certification of the potentially deficient equipment may be requested by the Departmental Representative. In the event that equipment does not meet specification, the Contractor is responsible for the cost of:
 - .1 All required laboratory tests.
 - .2 All subsequent testing and correction required.

PART 2 - PRODUCTS

- 2.1 Not Used .1 Not Used
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PART 3 - EXECUTION

- 3.1 Phase 1 – System Readiness .1 Before starting any of the separate systems, provide to the Commissioning Agent a certificate stating that the specific system is ready for start-up and the following conditions have been met.
 - .1 All safety controls installed and fully operational (dry run test).
 - .2 Qualified personnel are available to operate the equipment.
 - .3 Permanent electrical connections made to all equipment.
- .2 System readiness shall include, but not necessarily be limited to, the following:
 - .1 Checking system physical completion, including all instrumentation.
 - .2 Flushing, chemical cleaning (as required), charging, fluid treating (as required).
 - .3 Equipment lubrication and pre-start checks.
 - .4 Filter systems installed and sealed in place.
 - .5 Adjusting vibration isolation and seismic restraints.
 - .6 Control function checks, including all alarms.
 - .7 Self-diagnostic packaged control items checked.
- .3 All deficiencies to be recorded, reviewed by the Commissioning Team and, subsequently corrected before proceeding to the next phase, Phase 2.

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|--|-----------|---|
| <p>3.2 Phase 2 – System Start-Up, Testing, Balancing.</p> <hr/> | <p>.1</p> | <p>Phase 2 shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> .1 Activation of all sub-systems. .2 Testing and adjustment of all sub-systems. .3 Major or composite system activation. .4 Major or sub-system testing and adjustment. |
| | <p>.2</p> | <p>Pre-start checklists and check sheets for all mechanical equipment shall be signed off by the Mechanical Sub-Contractor and counter signed by the Commissioning Agent.</p> |
| | <p>.3</p> | <p>Co-ordinate the start-up of the various pieces of equipment and systems. Utilize the start-up services of the manufacturer’s representative. Ensure that the equipment is operating in a satisfactory manner.</p> |
| | <p>.4</p> | <p>Troubleshooting</p> <ul style="list-style-type: none"> .1 Resolve inter-contractor co-ordination problems. Where problems become apparent during the commissioning process, work at the identification and resolution of these problems. The basic functions in trouble shooting are: <ul style="list-style-type: none"> .1 What - Identification and definition of the problem. .2 Why - Determination and evaluation of the causes. .3 When - Determine the time available to resolve the problem. .4 Involve the Commissioning Agent in the review of the problem and proposed resolution. .5 Co-ordinate remedial action with the appropriate parties. .6 Evaluate the effectiveness of the remedial action. |
| | <p>.5</p> | <p>Test the operation of the individual components and systems. Go through each step of the sequence of operation and verify that each component operates correctly.</p> |
| | <p>.6</p> | <p>Ensure that all trades involved make the required changes and adjustments to affect the proper operation of all components and systems.</p> |
| | <p>.7</p> | <p>All deficiencies to be recorded, reviewed by the Commissioning Team and, subsequently corrected before proceeding to the next phase, Phase 3.</p> |
| <p>3.3 Phase 3 – Verification of System Commissioning.</p> <hr/> | <p>.1</p> | <p>Verification of commissioning by the Departmental Representative shall not commence until the commissioning process Phase 2, has been totally completed. Submit completion test certificates to the Departmental Representative at the time of requesting the commencement of the</p> |

verification procedure. The verification process will include the demonstration of the following:

- .1 Location of, and opening and closing of all access panels.
- .2 Operation of all automatic and manual control systems.
- .3 Operation of all equipment and systems, under each mode of operation.
- .4 Noise level under extreme operating conditions.

3.4 Phase 4 –
Demonstration
and Training

- .1 Demonstrate system operation and provide training in accordance with Section 01 79 00 – Demonstration and Training.

END OF SECTION

PART 1 - GENERAL

1.1	<u>General</u>	.1	This section specifies methods and procedures for demolishing, salvaging recycling and removing items designated to be removed in whole or in part.
1.2	<u>Related Sections</u>	.1	Section 01 35 33 – Health and Safety Requirements
		.2	Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
1.3	<u>References</u>	.1	Canadian Federal Legislation
		.1	Canadian Environmental Protection Act (CEPA), 1999, c. 33.
		.2	Canadian Environmental Assessment Act (CEAA), 2012.
		.3	Transportation of Dangerous Goods (TDGA), 1992, c. 34.
		.4	Motor Vehicle Safety Act (MVSA), 1995.
		.5	CSA S350 M1980 (R1998), Code of Practice for Safety in Demolition of Structures.
1.4	<u>Submittals</u>	.1	Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Sections 01 74 21 - Construction/ Demolition Waste Management and Disposal and 01 11 05 - General Instructions and indicate:
		.1	Descriptions of and anticipated quantities of materials to be salvaged reused, recycled and landfilled.
		.2	Schedule of selective demolition.
		.3	Number and location of dumpsters.
		.4	Anticipated frequency of tippage.
		.5	Name and address of waste facilities.
		.2	Prior to beginning of Work on site submit a detailed De-Commissioning Workplan for the existing sanitary lift station indicating the sequencing of decommissioning activities.
1.5	<u>Waste Management And Disposal</u>	.1	Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

- 1.6 Site Conditions
 - .1 Review Waste Reduction Workplan and take precautions to protect environment.
 - .2 Should material resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative.
 - .3 Notify Departmental Representative before disrupting site access or services.

PART 2 - PRODUCTS

- 2.1 Not Used

PART 3 - EXECUTION

- 3.1 Preparation
 - .1 Inspect site and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
 - .2 Locate and protect utilities using ground penetrating radar.
 - .3 Notify and obtain approval of utility companies before starting demolition.
 - .4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.
 - .1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.
 - .2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

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| <p>3.2 <u>Decommissioning Existing Sanitary Lift Station</u></p> | <ul style="list-style-type: none"> .1 Option 1 (preferred) <ul style="list-style-type: none"> .1 Complete removal and disposal of: <ul style="list-style-type: none"> .1 Wet well. .2 Pumps and switches. .3 Electrical and Instrumentation components. .2 Sealing off of all pipes connecting to the tank. .3 Backfill and compaction to Section 31 00 99 – Earthworks for Minor Works. .2 Option 2 (if soil stability concerns exist): <ul style="list-style-type: none"> .1 Thoroughly flush the tank and all connecting pipes. .2 Isolate wet well from all piping, electrical, and instrumentation connections by disconnecting and removing services and sealing off all pipes. .3 Strip the inside area of the tank of all components. .4 Remove the wet well lid and cut off and remove the tank wall to a minimum 1 meter depth below finished surface. .5 Drill eight (8) symmetrical 100 mm diameter holes per each metre of height of remaining, in place, tank. .6 Fill the wet well with lightly compacted clean river sand and install a single layer of non-woven filter fabric against each drilled hole. |
| <p>3.3 <u>Removal Operations</u></p> | <ul style="list-style-type: none"> .1 Remove items as indicated on drawings and directed by Department Representative. .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Departmental Representative. .3 Removal of Pavements, Curbs and Gutters: <ul style="list-style-type: none"> .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative. .2 Protect adjacent joints and load transfer devices. .4 Protect underlying and adjacent granular materials. |

- .5 Prevent movement, settlement, or damage to adjacent structures and utilities to remain in place. Provide bracing and shoring required.
- .6 Protect building systems, services and equipment.
- .7 Do Work in accordance with Section 01 35 33 - Health and Safety Requirements.
- .8 Sealing
 - .1 Seal pipe ends and walls of manholes or catch basins as indicated. Securely plug to form watertight seal.
- .9 Backfill
 - .1 Backfill in areas as indicated.
 - .2 Backfill material and compaction to Section 31 00 99 – Earthworks for Minor Works
- 3.4 Salvage
 - .1 Remove items to be reused, store as directed by Departmental Representative and re install where specified.
- 3.5 Restoration
 - .1 Restore areas and existing works outside areas of demolition to match conditions of adjacent, undisturbed areas.
 - .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- 3.6 Clean Up
 - .1 Restore areas and existing works outside areas of demolition to match conditions of adjacent, undisturbed areas.
 - .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- 3.7 Disposal
 - .1 Dispose of removed materials to appropriate recycling facilities, except where specified otherwise, in accordance with authority having jurisdiction.

END OF SECTION

PART 1 - GENERAL

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| 1.1 | Section Includes | .1 | Procedures for working with and removal of sub-surface asbestos pipe. |
| | | .2 | Removal (other than defined minor amounts) of friable materials containing asbestos. |
| | | .3 | Use of power tools that are fitted with dust collectors equipped with a HEPA filter to cut, shape, grind, drill, scrape, or abrade manufactured products containing asbestos. |
| 1.2 | Related Sections | .1 | Section 01 35 33 – Health and Safety Requirements. |
| | | .2 | Section 01 74 21 – Waste Management And Disposal. |
| 1.3 | References | .1 | Codes and standards referenced in this section refer to the latest edition thereof. |
| | | .2 | Canadian General Standards Board (CGSB) |
| | | .1 | CAN/CGSB-1.205, Sealer for Application to Asbestos-Fibre-Releasing Materials. |
| | | .3 | Province of British Columbia: |
| | | .1 | Workers Compensation Act Part 6 - Asbestos |
| 1.4 | Definitions | .1 | HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency. |
| | | .2 | 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 identified under Existing Conditions (Article 1.7), including fallen materials and settled dust. |
| | | .4 | Asbestos Work Area: Area where actual removal, sealing and enclosure of spray or trowel-applied asbestos-containing materials takes place. |
| | | .5 | Authorized Visitors: Department Representative, Asbestos Abatement Consultant or designated representative , and persons representing regulatory agencies. |
| | | .6 | Friable Material: Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered. |

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- .7 Occupied Area: Any area of the work site that is outside the Asbestos Work Area.
 - .8 Polyethylene sheeting sealed with tape: Polyethylene sheeting of type and thickness specified sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through the sheeting into a clean area.
 - .9 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 Straps for sealing ends around pipe.
 - .4 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.
- 1.5 Submittals
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- .1 Before commencing work:
 - .1 Obtain from the appropriate agency and submit to Department Representative all 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 Department Representative that suitable arrangements have been made to receive and properly dispose of asbestos waste.
 - .2 Submit proof satisfactory to Department Representative that all employees have had instruction on the hazards of asbestos exposure, respirator use, dress, use of showers, entry and exit from work areas, and all aspects of work procedures and protective measures. Supervisory personnel shall have attended an asbestos abatement course, of not less than two days duration, approved by the Department Representative. Submit proof of attendance in the form of a certificate. Minimum of one Supervisor for every five workers.
 - .3 Submit layout of proposed enclosures and decontamination facilities to Department Representative for review.
 - .4 Submit documentation including test results for sealer proposed for

use.

- .5 Submit Provincial and/or local requirements for Notice of Project Form.
- .6 Submit proof of Contractor’s Asbestos Liability Insurance.
- .7 Submit proof satisfactory to the Department Representative that all employees have respirator fitting and testing. Workers must be fit-tested with the respirator that is personally issued.
- .8 Submit Workplace Health, Safety and Compensation Commission status and transcription of insurance.
- .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets for chemicals or materials including but not limited to the following:
 - .1 Encapsulants
 - .2 Amended water
 - .3 Slow-drying sealer

1.6 Regulatory Requirements

- .1 Comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications the more stringent requirement applies. Comply with regulations in effect at the time the work is performed.
- .2 Follow British Columbia Regulation of the Occupation Health and Safety Act, Asbestos Abatement Regulations, Latest Edition. All work as defined under this section must be completed by a “Qualified Asbestos Abatement Contractor”.
- .3 Follow regulations for the transport of asbestos waste, specifically the Transportation of Dangerous Goods Act, latest edition.
- .4 Follow regulations for the disposal of asbestos waste, specifically Waste Management Regulations and Waste Material Disposal Areas Regulations.

1.7 Existing Conditions

- .1 Prior to commencing of work, verify with Department Representative, and review whether an asbestos audit and/or Asbestos Management Plan are in place for the worksite.
- .2 Information contained in audits and plans are for general information only and are not necessarily representative of all asbestos containing materials covered within the scope of this project.
- .3 Notify Department Representative of materials believed to contain

			asbestos encountered during the execution of work that is not contained in the audits and plans. Do not disturb such materials until instructed by Department Representative.
1.8	Instruction and Training	.1	Before commencing work, provide to the Department Representative satisfactory proof that every worker has had instruction and training in the hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from the Asbestos Work Area, in all aspects of work procedures including glove bag procedures, and in the use, cleaning, and disposal of respirators and protective clothing.
		.2	Instruction and training related to respirators includes, at a minimum: <ul style="list-style-type: none"> .1 Proper fitting of the equipment. .2 Inspection and maintenance of the equipment. .3 Disinfecting of the equipment. .4 Limitations of the equipment.
		.3	Instruction and training must be provided by a competent, qualified person.
		.4	Supervisory personnel to complete required training.
1.9	Worker Protection	.1	Protective equipment and clothing to be worn by workers while in the Asbestos Work Area includes: <ul style="list-style-type: none"> .1 Respirator equipped with HEPA filter cartridges, personally issued to the worker and marked as to efficiency and purpose, and acceptable to the Provincial Authority having jurisdiction as suitable for the type of asbestos and the level of asbestos exposure in the Asbestos Work Area. If disposable type filters are used, provide sufficient filters so that workers can install new filters following disposal of used filters and before re-entering contaminated areas. .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres, consisting of full-body covering including head covering with snug-fitting cuffs at wrists, ankles, and neck.
		.2	Each worker shall: <ul style="list-style-type: none"> .1 Remove street clothes in Clean Room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Asbestos Work

Area. All street clothes, uncontaminated footwear, towels, and similar uncontaminated articles shall be stored in Clean Room.

- .2 Remove gross contamination from clothing before leaving work area. Place contaminated worksuits in receptacles for disposal with other asbestos - contaminated materials. Clean outside of respirator with soap and water. Remove respirator; remove filters and wet them and dispose of filters in the container provided for the purpose; and wash and rinse the inside of the respirator. When not in use in the work area, store work footwear in change 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.

- .3 Provide facilities for washing and/or showering when leaving Asbestos Work Area, which shall be used by every worker. Hot and cold water supply is to be provided in such a manner to allow workers to adjust water temperature during decontamination.

- .3 Workers shall not eat, drink, smoke or chew gum or tobacco at the work site except in established clean room.

- .4 Workers shall be fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.

- .5 Provide and post in Clean Room and Equipment and Access Room the procedures described in 1.9 of this section, in both official languages.

- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects the seal between the respirator and the face.

1.10 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 and respirators.
- .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from work areas.

1.11 Notification

- .1 Provide project notification to WorksafeBC.
- .2 Notify Sanitary Landfill site.
- .3 Inform all sub-trades of the presence of friable asbestos-containing

materials identified in the Existing Conditions.

- .4 Submit to the Department Representative a copy of all notifications prior to the start of work.

PART 2 - PRODUCTS

2.1 Materials

- .1 All materials and equipment brought to work site must be in good condition and free of asbestos, asbestos debris, and fibrous materials. Disposable items must be of new materials only.
- .2 Polyethylene: Minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .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 Department Representative, mixed with water in a concentration to provide adequate penetration and wetting of asbestos-containing material.
- .5 Asbestos waste containers: Metal or fibre - type acceptable to dump operator with tightly fitting covers and 0.15 mm minimum thickness sealable polyethylene liners. Labelling requirements: Affix a pre-printed cautionary asbestos warning, in both official languages, that is clearly visible when ready for removal to disposal site.
- .6 Encapsulants : Type 2 surface film forming type Class A water based conforming to CAN/CGSB-1.205, ULC listed.
- .7 Glove bag: Acceptable materials include safe-T-strip products in configuration suitable for work, or alternative approved material. Glove bags intended for use in more than one location must be equipped with a reversible, double-pull, double-throw zipper on the top and at approximately the mid-section of the bag.
- .8 Slow drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for the purpose of trapping residual asbestos fibres. Sealer shall have flame spread and smoke developed rating less than 50.

PART 3 - EXECUTION

3.1 Preparation

- .1 Work Areas:
 - .1 At each access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where the number in parentheses indicates the font size to be used : "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)".
 - .2 Locate and mark all underground utilities.
 - .3 Excavate and shore or slope the excavation (if required) in accordance with City of Penticton and WorkSafeBC regulations. Excavate a sufficient distance around the asbestos pipe to assure adequate tool clearance in the area to be cut (or drilled). Care must be taken to avoid disturbance of the asbestos cement pipe through use of tools and equipment prior to donning PPE.
- .2 Portable Worker Decontamination Enclosure System shall comprise an Equipment and Access Room, a Wash Area Room, and a Clean Room, as follows:
 - .1 Equipment and Access Room: Equipment and Access Room between Wash Area Room and work area, with two curtained doorways, one to the Wash Area Room and one to work area. Portable toilet, waste receptor, and storage facilities for workers' shoes and any protective clothing to be re-worn in work area. The Equipment and Access Room shall be large enough to accommodate specified facilities, any other equipment needed, and at least one worker allowing him/her sufficient space to undress comfortably.
 - .2 Wash Area Room: Wash Area Room between the Clean Room and Equipment and Access Room, with two curtained doorways, one to the Clean Room and one to Equipment and Access Room. Provide a constant supply of hot and cold or warm water. Provide piping and connect to water sources and drains. Pump waste water through a 5 micrometre filter system acceptable to Department Representative before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.
 - .3 Clean Room: Clean Room between the Wash Area Room and clean areas outside of enclosures, with two curtained doorways, one to

outside of enclosures and one to Wash Area Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install a mirror to permit workers to fit respiratory equipment properly.

- .3 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 the beginning of each working period.
 - .4 Use smoke methods to test effectiveness of barriers when directed by Department Representative.
- .4 Asbestos Abatement work shall not commence until:
 - .1 Arrangements have been made for disposal of waste.
 - .2 Work area and decontamination enclosures are effectively segregated.
 - .3 Tools, equipment, and materials waste containers are on hand.
 - .4 Warning signs specified in PART 3 are displayed where access to contaminated areas is possible.
 - .5 All notifications have been completed and other preparatory steps have been taken.

3.2 Supervision

- .1 A minimum of one Supervisor for every five workers is required. Refer to Asbestos Abatement Regulations for definition and training of supervisor.
- .2 An approved Supervisor must remain within the Asbestos Work Area at all times during the disturbance, removal, or other handling of asbestos-containing materials.

3.3 Working with Asbestos Pipe

- .1 Once work has commenced on the pipe, workers, equipment, and materials shall not leave the Asbestos Work Area without going through the decontamination procedure. Only authorized personnel who are equipped with the proper PPE may enter the work area.
- .2 The area of asbestos pipe affected by disturbance must be sufficiently wetted prior to the disturbance to remove any dirt, sand or gravel.

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- .3 Measure the length of cut and mark with a crayon or grease pencil and attach the snap cutters.
 - .4 Apply water to the area being cut and continue until the cutting has been completed.
 - .5 Operate cutting and drilling tools (and any other equipment used for disturbing asbestos pipe) in accordance with the manufacturer's instructions, making sure that water is continually applied in sufficient quantities to minimize dust.
 - .6 Detach the cutting equipment and repeat the above mentioned cutting steps. Move to the next cutting location and wet the cutting area prior to the cut. Recheck the measurement and remark if necessary. Again, apply water to the area being cut and continue until the cutting has been completed.
 - .7 Install all pipes, fittings, and couplings – as per Contract and City of Penticton Specifications – required to complete the job, taking care to avoid abrasions to the asbestos pipe. Keep the asbestos pipe moist during the work process.
 - .8 Once work in the excavated zone is completed, move any tools and materials from the work zone to the decontamination area.
- 3.4 Disposing of Asbestos Pipe
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- .1 Removal from trench:
 - .1 Using Asbestos Waste Bags
 - .1 Cut the pipe in to 1.2 m lengths.
 - .2 Place pipe segments and all visible pieces of asbestos debris in the Asbestos Waste Bags while still in the trench.
 - .3 Package in accordance with 3.6 Asbestos Contaminated Waste Disposal.
 - .2 Using Polyethylene drop sheets
 - .1 Place two layers of polyethylene drop sheet under the section of asbestos pipe to be removed.
 - .2 Remove the section of asbestos pipe and place it directly on the Polyethylene drop sheets.
 - .3 Wrap the first layer of Polyethylene drop sheet around the pipe, tie the ends in a "goose neck", and seal with duct tape.
 - .4 Repeat 3.4.2.3 for the second Polyethylene drop sheet.

- .5 Label an Asbestos Warning Sticker.
- .3 Dispose of at designated Asbestos Disposal Facility.
- .2 Where the Department Representative determines it is permissible, the asbestos may be left in the trench whole:
 - .1 Package asbestos pipe in accordance with 3.4.1.1 and 3.4.1.2.
 - .2 Abandon the bagged asbestos pipe in the trench.
 - .3 Document the amounts and locations of the buried asbestos pipe.
 - .4 Backfill as per usual procedure, placing "Asbestos Hazard" warning tape 0.6 m below the surface.
 - .5 Forward the amounts and locations of the buried asbestos pipe to the Department Representative.
- 3.5 Clean-up and Decontamination
 - .1 Tools and materials to be thoroughly washed and inspected prior to being removed from the Asbestos Work Area.
 - .2 PPE and tools that are to be reused:
 - .1 Clean and immerse in a bucket of water, followed by a second immersion in a second, clean bucket of water.
 - .2 Inspect thoroughly for asbestos contamination and repeat if necessary until all asbestos containing materials have been removed.
 - .3 Place the object outside the Asbestos Work Area.
 - .3 Object too large to be washed in a bucket:
 - .1 Use a wet cloth to wipe down until visually "clean".
 - .2 Inspect thoroughly for asbestos contamination and repeat if necessary until all material has been removed from the item.
 - .4 Personal Decontamination:
 - .1 Remove all debris from protective clothing using a damp cloth, sponge, or HEPA filtered vacuum.
 - .2 Remove disposable suits and place them in a designated waste bag labelled 'Asbestos Waste'. Package in accordance with 3.6 Asbestos Contaminated Waste Disposal.
 - .3 Leave work area boundary while still wearing a respirator.
 - .4 Thoroughly wash hands, respirator, and face with a clean sponge or damp cloth from the designated clean water bucket.

- .5 Seal HEPA filters with duct tape and place them along with the respirator in a sealable bag for storage.
- 3.6 Asbestos Contaminated Waste Disposal
-
- .1 Place all asbestos contaminated waste in a disposal bag labelled 'Asbestos Waste'.
 - .2 Gently squeeze the bag to expel excess air.
 - .3 Tightly twist the unused top portion of the bag into a tail and seal it with duct tape at the base of the tail.
 - .4 Take the leftover twisted section of the bag and bend it around to make a loop and attach it to the base of the tail using the duct tape.
 - .5 Place the first bag inside a second bag and repeat steps 3.5.2 to 3.5.4.
 - .6 Dispose of at designated Asbestos Disposal Facility.
- 3.7 Inspection
-
- .1 Inspection of the Asbestos Work Area will be performed to confirm compliance with the requirements of the specifications and governing authorities. Deviation from the Asbestos Abatement Regulations is not accepted without prior approval of the governing authority. Any deviation from these requirements that have not been approved in writing by the Department Representative and the governing authority may result in a stoppage of work, at no cost to the Owner.
 - .2 The Department Representative is empowered to inspect adherence to specific procedures and materials, and to inspect for final cleanliness and completion. Additional labour or materials expended by the Contractor to provide performance to the level specified shall be at no additional cost.
 - .3 The Department Representative is empowered to order a shutdown of work when a leakage of asbestos from the Asbestos Work Area has occurred or is likely to occur. Additional labour or materials expended by the Contractor to provide performance to the level specified shall be at no additional cost.

END OF SECTION

PART 1 - GENERAL

1.1	Related Sections	.1	Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
		.2	Section 03 30 00 Cast-in-Place Concrete
1.2	Price and Payment Procedures	.1	Payment for reinforcement will be made as a component of cast-in-place concrete. No separate payment will be made.
1.3	References	.1	American Concrete Institute (ACI)
		.1	ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.
		.2	ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
		.2	American Society for Testing and Materials International (ASTM)
		.1	ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
		.2	ASTM A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
		.3	Canadian Standards Association (CSA)
		.1	CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of test and Standard Practices for Concrete.
		.2	CSA-A23.3, Design of Concrete Structures.
		.3	CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada
		.4	CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel /Structural Quality Steel.
		.5	CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
		.6	CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
		.3	Reinforcing Steel Institute of Canada (RSIC)
		.1	Reinforcing Steel Manual of Standard Practice

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|-------------------|-----------------------------------|--|--|
| 1.4 | Submittals | | <ul style="list-style-type: none"> .1 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacing, and locations of reinforcement with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacing and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada . ANSI/ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure. .2 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated. |
| 1.5 | Delivery, Storage
And Handling | | <ul style="list-style-type: none"> .1 Ship reinforcing steel in bundles with identifying tags or markings. Take necessary precautions to maintain identification after the bundles are broken. .2 Store reinforcing steel above ground on platforms, skids, or racks and protect from prolonged exposure to weather. |
| PART 2 - PRODUCTS | | | |
| 2.1 | Materials | | <ul style="list-style-type: none"> .1 Substitute different size bars only if permitted in writing by the Departmental Representative. .2 Reinforcing Steel: billet-steel deformed bars to CAN/ CSA-G30.18, Grade 400R, bearing identifying marks indicating size and grade. .3 Cold-drawn annealed steel wire ties: to ASTM A497/A497M. .4 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only. .5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2. .6 Mechanical splices: subject to approval of Departmental Representative. .7 Plain round bars: to CSA-G40.20/G40.21. |
| 2.2 | Fabrication | | <ul style="list-style-type: none"> .1 Fabricate reinforcing steel in accordance with CSA-A23.1A23.2, ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada. .2 Obtain Department Representative’s approval for locations of reinforcement splices other than those shown on placing drawings. |

- .3 Upon approval of Department Representative, weld reinforcement in accordance with CSA W186.
 - .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- 2.3 Source Quality Control
-
- .1 Upon request, provide Department Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.
 - .2 Upon request, inform Department Representative of proposed source of material to be supplied.

PART 3 - EXECUTION

- 3.1 Fabrication And Erection
-
- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1 and RSIC Reinforcing Steel Manual of Standard Practice, unless indicated otherwise.
 - .2 Obtain the Departmental Representative's approval for locations of reinforcement splices other than shown on the Drawings.
- 3.2 Field Bending
-
- .1 Do not field bend reinforcement except where indicated or authorized by the Departmental Representative.
 - .2 When field bending is authorized, bend without heat, applying a slow and steady pressure. Replace bars which develop cracks or splits.
- 3.3 Placing Of Reinforcement
-
- .1 Place reinforcing steel as indicated on Drawings and in accordance with CAN/ CSA-A23.1. Ensure materials, before being placed, are free of loose scaly rust, dirt, oil, paint or other bond-breaking coating.
 - .2 Prior to placing concrete, obtain the Departmental Representative's approval of reinforcing steel placement. The Departmental Representative's approval indicates review for general conformance with the contract documents only and does not relieve the Contractor of his responsibility for the accuracy and correctness of the Work.
 - .3 Unless indicated otherwise on the Drawings, provide minimum concrete cover for reinforcement in cast-in-place concrete as follows:
 - .1 Cast against earth: 75 mm
 - .2 All other: 50 mm

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- .4 Tolerances for placing reinforcing steel shall be in accordance with CAN/CSA-A23.1 as applicable, except that concrete cover to reinforcing steel shall not be reduced by more than 6 mm.

END OF SECTION

PART 1 - GENERAL

1.1	Related Sections	.1	Section 03 20 00 – Concrete Reinforcing
<hr/>		.2	Section 31 00 99 – Earthworks for Minor Works.
		.3	Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type
		.4	Section 33 05 13 – Manholes and Catch Basin Structures
1.2	Price and Payment Procedures	.1	Cast-in-place concrete will be measured incidental to other items that it forms a component of per the requirements of the Contract Drawings.
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1.3	References	.1	CAN/ CSA-A23.1 Concrete Materials and Methods of Concrete Construction (Including Notes and Appendices in the Standard)
<hr/>		.2	CAN/ CSA-A23.2 Test methods and standard practices for Concrete
		.3	CAN/ CSA-S269.3 Concrete Formwork
		.4	CAN/ CSA A3000 Supplementary Cementing Materials, Building Materials and Products
		.5	ACI 305R Hot weather concreting
		.6	ACI 306R Cold weather concreting
		.7	ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
		.8	ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
		.9	ASTM C494 Standard Specification for Chemical Admixtures for Concrete
		.10	Additional material and testing standards listed in CAN/ CSA-A23.1.
1.4	Submittals	.1	Submit concrete mix designs of any mix designed by the Contractor to the Departmental Representative for review 14 days prior to placement. Concrete mix design submittals shall include the mass in kilograms of fine aggregate, coarse aggregate, cement, fly ash, silica fume and water in each cubic metre of concrete. Concrete mix design submittals shall specify the properties of the concrete.
<hr/>		.2	Submit copies of all test results to the Departmental Representative for review. Submission of test results will not relieve the Contractor from his obligation to interpret the test results and make necessary corrections or adjustments to his construction procedures or mix designs..
		3	At least four weeks prior to commencing work of this section, inform the

			Departmental Representative of proposed source of aggregates and provide access for sampling.
		.4	Submit a letter of assurance that the proposed aggregate source will not produce concrete that will be compromised by deleterious effects from alkali-aggregate reaction.
1.5	Quality Control Submittals	.1	Provide proof of certification that plant, equipment, and materials including aggregates to be used in concrete comply with requirements of CAN/ CSA-A23.1.
		.2	Submit test results based on trial mixes showing that concrete mix designs will produce concrete meeting the requirements of this section and that strength will comply with CAN/ CSA-A23.1.
		.3	Submit manufacturer's datasheets and printed instructions for joint sealant and primer proposed for use in the Work.
1.6	Quality Assurance	.1	Perform all concrete Work in accordance with the requirements of CAN/ CSA A23.1.
		.2	Concrete testing shall be performed by the Contractor, and results submitted to the Departmental Representative.
 PART 2 - PRODUCTS			
2.1	Concrete Materials	.1	Portland Cement and Supplementary Cementing Material : Type GU Portland cement to CAN/ CSA-A3000
		.2	Water: to CAN/ CSA-A23.1.
		.3	Aggregates: to CAN/ CSA-A23.1, normal density.
		.4	Air Entraining Admixtures: to ASTM C260.
		.5	Chemical Admixtures: to ASTM C494. Departmental Representative to approve type and use of accelerating or set-retarding admixtures during cold and hot weather placing.
		.6	Curing Compound: to CSA A23.1 and ASTM C309
2.2	Formwork Materials	.1	Formwork materials shall meet the requirements of CAN/ CSA-S269.3 and this section.
		.2	Contact surfaces or lining of formwork shall be suitably smooth to provide finished concrete surfaces meeting the requirements of this section.
		.3	Form Ties: threaded internal disconnecting type, leaving no holes larger than 1 in. diameter in concrete surface.

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- .4 Form Release Agent: non-staining chemically active release agent, compatible with form material which will prevent adherence of concrete to forms.
- 2.3 Concrete Mixes
-
- .1 Select concrete mix proportions in accordance with CAN/ CSA-A23.1 to give the following properties for all cast-in-place concrete unless specified otherwise on design Drawings:
 - .1 Minimum Compressive Strength at 28 Days: 35 MPa.
 - .2 Maximum Water/Cementing Materials Ratio: 0.40.
 - .3 Exposure Class: C-1.
 - .4 Nominal Maximum Size of Coarse Aggregate: 20 mm.
 - .5 Slump at Time and Point of Discharge: 130 mm ± 25 mm.
 - .6 Air Content: 5% to 8%.
 - .2 Do not change concrete mix without prior approval of the Departmental Representative. Should change in material source be proposed, new mix design to be approved by the Departmental Representative.
- 2.4 Concrete Production
-
- .1 Measure, batch and mix concrete in accordance with CAN/ CSA-A23.1.
 - .2 Before unloading concrete at the Site, furnish the Departmental Representative with a delivery ticket for each batch of concrete in accordance with CAN/ CSA-A23.1.

PART 3 - EXECUTION

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- 3.1 General
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- .1 Prior to placing concrete, ensure that all reinforcing and other items to be embedded in concrete are in place, properly oriented, located, and secured. Verify that concrete may be placed to the lines and elevations shown on the Drawings with all required clearances and cover for reinforcement. Ensure that forms are clean and absolutely all debris has been removed.
 - .2 Obtain the Departmental Representative's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.
 - .3 Prior to placing concrete, obtain the Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
 - .4 Maintain accurate records of poured concrete items to indicate date, location of pour, quantity, air temperature and any Contractor's test samples taken.

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| 3.2 | Formwork | .1 | Construct and erect formwork in accordance with CAN/ CSA-S269.3. |
| | | .2 | Assemble forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/ CSA-A23.1. |
| | | .3 | Align form joints and make watertight. Use minimum number of form joints. |
| | | .4 | Clean formwork in accordance with CAN/ CSA-A23.1 before placing concrete. |
| 3.3 | Preparation | .1 | Set sleeves, anchor bolts and other inserts as indicated or specified elsewhere. Sleeves and openings greater than 100 mm and not indicated on structural Drawings must be approved by the Departmental Representative. |
| | | .2 | Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Departmental Representative before placing of concrete. |
| 3.4 | Placing of Concrete
– General | .1 | Handle, deposit and consolidate concrete in accordance with CAN/ CSA-A23.1 and ACI A309R. Take care not to disturb forms or reinforcing steel when depositing and consolidating concrete. |
| | | .2 | Ensure that spare internal vibrators or external form vibrators are on hand during placing of concrete. |
| | | .3 | Unless specified otherwise, where fresh concrete will be placed against hardened concrete, bond the fresh concrete to the hardened concrete in accordance with CAN/ CSA-A23.1. |
| 3.5 | Construction Joints | .1 | Make construction joints in accordance with CAN/ CSA-A23.1. |
| | | .2 | Locate construction joints as indicated on the Drawings or as approved by the Departmental Representative. Construction joints not indicated on the Drawings will not be permitted without the prior authorization of the Departmental Representative. |
| 3.6 | Finishing Unformed Surfaces | .1 | Top surfaces of concrete which will ultimately receive additional concrete: |
| | | .1 | Screed the surface across the grade strips or forms so that the resulting surface will have no irregularities greater than the maximum size aggregate. |
| | | .2 | Roughen the surface with 6 mm amplitude. |
| | | .3 | Prior to placing additional concrete, clean the surface of: laitance, |

dirt, excess water, and other deleterious material. Do not use hydro-milling until sufficient time has elapsed to prevent loosening of the top aggregate.

- .2 Top Surface of Exposed Concrete:
 - .1 Initial Finishing: immediately after placing concrete, screed the surface to the indicated grade and Work the surface with a bull float, or with a darby and highway straight edge, in accordance with CAN/ CSA-A23.1. Complete initial finishing before any bleeding or free water is present on the concrete surface.
 - .2 Begin final finishing operations after the bleed water has disappeared and the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface. Do not add water to facilitate finishing. Carry out final finishing operations in accordance with CAN/ CSA-A23.1.
 - .3 Unless noted otherwise, exterior surfaces shall receive a light broom finish, with broom striations approximately 2 mm deep.
- .3 Finished surfaces shall conform to the slopes specified on the Drawings.

3.7 Finishing Formed Surfaces

- .1 Finish formed surfaces in accordance with CAN/CSA-A23.1 and as specified below.
- .2 Formed surfaces which may ultimately serve as forms for additional concrete pour or which will remain unexposed:
 - .1 The surface may contain shear keys, reinforcing steel, anchor bolts, or other embedments as indicated on the Drawings.
 - .2 Repair honeycomb concrete and fill form-tie holes. Remove fins and ridges from concrete surfaces.
 - .3 Clean the surface of laitance, dirt, excess water, and other deleterious material prior to applying waterproofing treatment or placing additional concrete.

3.8 Curing And Protection

- .1 Cure and protect concrete in accordance with CAN/ CSA-A23.1 and as specified below.
- .2 Cure topping concrete by the application of wetted burlap immediately after completion of finishing operations. Maintain burlap in a saturated condition using soaker hoses wrapped in burlap and installed on top of the deck surface. When the daily mean ambient temperature is above 5 deg. C, curing shall be continuous for a minimum of seven days or for the time necessary to attain 70% of the specified 28 day compressive strength.

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- .3 When the air temperature is at or above 27 deg. C, or when there is a probability of it rising to 27 deg. C during the placing period (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 305R - Hot Weather Concreting.
 - .4 When the air temperature is at or below 5 deg. C, or when there is a probability of it falling below 5 deg. C within 24 hours of placing (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 306R - Cold Weather Concreting.
- 3.9 Tolerances
-
- .1 Tolerances for concrete Work as built shall conform to CAN/ CSA-A23.1 unless indicated otherwise.
 - .2 Finish tolerances for concrete topping shall meet the requirements for the conventional (non-slip) Class B surface of CAN/ CSA-A23.1 Table 16.
 - .3 The flatness of the topping surface will be determined by the straightedge method as outlined in CAN/ CSA-A23.1.
- 3.10 Field Quality Control
-
- .1 Inspection and testing of concrete and concrete materials shall be carried out by a Testing Laboratory approved by Departmental Representative, engaged and paid for by the Contractor, in accordance with CAN/ CSA A23.1.A "test" shall consist of a slump test, an air entrainment test, and samples collected for compression testing.
 - .2 Pumped concrete shall be sampled both at the truck discharge and at the point of final placement to determine if any changes in the slump, air content or other significant mix characteristics occur. The concrete at the forms shall meet all the requirements of this section.
 - .3 Additional test cylinders shall be taken during cold weather concreting. Cure cylinders on job Site under same conditions as concrete which they represent.
 - .4 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 33.
- .2 The Contractor shall familiarize himself with all plans including those of sub-trades, and arrange his equipment with due regard to all civil, structural, and mechanical fixtures. The civil, structural, and mechanical plans shall be consulted for final locations of wet well, pipe work, equipment, etc.
- .3 The Contractor shall supply all wiring and equipment necessary to complete properly operating systems as specified herein. All material, labour, tools, and appliances necessary for the work shall be furnished by the Contractor.

1.2 Reference

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .2 CAN/CSA-22.3 No. 1, Overhead Systems.
 - .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.3 Care, Operation and Start-Up

- .1 Instruct Department Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start-up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Arrange and pay for services of manufacturer's factory service

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| | | | engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel. |
| | .4 | | 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. |
| 1.4 | 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. Equipment to operate in extreme operating conditions established in above standard without damage to equipment. |
| 1.5 | Submittals | .1 | Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation. |
| | | .2 | Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment. |
| | | .3 | Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices. |
| | | .4 | Quality Control: <ul style="list-style-type: none"> .1 Provide CSA certified equipment and material. .2 Submit test results of installed electrical systems and instrumentation. .3 Submit, upon completion of Work, load balance report as described in PART 3.6.4 – LOAD BALANCE. .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Department Representative. |
| | | .5 | Manufacturer's Field Reports: submit to Department Representative |

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- within 7 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3.6 - FIELD QUALITY CONTROL.
- 1.6 Permits, Fees and Inspections
-
- .1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
 - .2 Pay associated fees.
 - .3 Department Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.
 - .4 Notify Department Representative of changes required by Electrical Inspection Division prior to making changes.
 - .5 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Department Representative.
- 1.7 Co-ordinating
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- .1 Co-ordinate work with work of other divisions to avoid conflict.
 - .2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.
 - .3 Locate all existing underground services and make all parties aware of their existence and location.
 - .4 Where interference occurs, Department Representative must approve relocation of equipment and materials regardless of installation order.
 - .5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Department Representative shall decide the extent of relocation required.

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| 1.8 | Protection | .1 | Protect exposed live equipment during construction for personnel safety. |
| | | .2 | Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English. |
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| 1.9 | Record Drawings | .1 | Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting. |
| | | .2 | Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building. |
| | | .3 | Indicate exact location of all services for future work. Show and dimension all work embedded in the structure. |
| | | .4 | Submit record drawings within 30 days prior to start of commissioning. |
| <hr/> | | | |
| 1.10 | Inspection of Work | .1 | The Owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority. |
| <hr/> | | | |
| 1.11 | Scheduling of Work | .1 | Work shall be scheduled in phases as per other divisions of the master project specifications. |
| | | .2 | Become familiar with the phasing requirements for the work (if any) and comply with these conditions. |
| | | .3 | No additional monies will be paid for contractor's requirement to comply with work phasing conditions. |

PART 2 - PRODUCTS

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| 2.1 | Electric Motors, Equipment and Controls | .1 | Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings. |
| <hr/> | | | |
| 2.2 | Materials and Equipment | .1 | Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division. |
| | | .2 | Factory assemble control panels and component assemblies. |
| 2.3 | 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 to EEMAC Y1-1. |
| 2.4 | Warning Signs | .1 | As specified and to meet requirements of Electrical Inspection Department and Department Representative. |
| | | .2 | Porcelain enamel decal signs, minimum size 175 x 250 mm. |
| 2.5 | Wiring Termination | .1 | Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminium conductors. |
| 2.6 | Equipment Identification | .1 | Identify electrical equipment with nameplates and labels as follows: |
| | | .1 | Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws. |
| | | .2 | Sizes as follows: |
| | | | NAMEPLATE SIZES |
| | | | Size 1 10 x 50 mm 1 line 3 mm high letters |
| | | | Size 2 12 x 70 mm 1 line 5 mm high letters |
| | | | Size 3 12 x 70 mm 2 lines 3 mm high letters |
| | | | Size 4 20 x 90 mm 1 line 8 mm high letters |
| | | | Size 5 20 x 90 mm 2 lines 5 mm high letters |
| | | | Size 6 25 x 100 mm 1 line 12 mm high letters |
| | | | Size 7 25 x 100 mm 2 lines 6 mm high letters |

- .2 Labels:
 - .1 Embossed plastic labels with 6 mm high letters unless specified otherwise.
 - .3 Wording on nameplates and labels to be approved by Department Representative prior to manufacture.
 - .4 Allow for average of twenty-five (25) letters per nameplate and label.
 - .5 Identification to be English (and French where applicable).
 - .6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.
 - .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
 - .8 Terminal cabinets and pull boxes: indicate system name and voltage.
 - .9 Transformers: indicate capacity, primary and secondary voltages and transformer number.

2.7 Wiring Identification

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1, Canadian Electrical Code.
- .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 primer colour and 20 mm wide auxiliary Colour.

<u>Conduit System</u>	<u>Primer Color</u>	<u>Auxiliary Color</u>
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue

PART 3 - EXECUTION

3.1	Nameplates and Labels	.1	Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.
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3.2	Conduit and Cable Installation	.1	Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
		.2	Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
		.3	Conduit – Rigid polyvinyl chloride to conform to CSA C22.2 No 211.1
3.3	Co-Ordination of Protective Devices	.1	Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
<hr/>			
3.4	Wiring	.1	Wiring to conform to requirements of Canadian Electrical Code
		.2	Secure conductor splices with solderless type connectors
		.3	Conductors copper unless otherwise noted
3.5	Grounding	.1	Electrical cabinet main ground No 6. RW90 to galvanized steel plate.
		2.	Welded ground clamp, c/w 20mm diameter steel rod welded to plate.
		3.	Plate minimum surface area 0.2 square meters
		4.	Plate minimum thickness 6mm
		5.	Plate electrode burial depth 900mm minimum.
		6.	Refer to MMCD standard detail E7.10
3.6	Field Quality Control	.1	All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification.

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- Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.
 - .3 Perform tests in accordance with this section as noted and Section 01 79 00 – Demonstration and Training.
 - .4 Conduct and pay for following tests:
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operations of systems where applicable.
 - .5 Systems: communications.
 - .6 Furnish manufacturer’s certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer’s instructions.
 - .7 Insulation resistance testing.
 - .1 Megger and record circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Check resistance to ground before energizing and record value.
 - .8 Carry out tests in presence of Department Representative.
 - .9 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.
 - .10 Submit test results for Department Representative’s review and include in Commissioning Manuals specified in Section 01 78 00 – Closeout Submittals and Section 01 79 00 – Demonstration and Training.

3.7 Cleaning

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

PART 1 - GENERAL

<u>1.1 Section Includes</u>	.1	Materials and installation for industrial control devices including pushbutton stations, control and relay panels.
<u>1.2 Related Sections</u>	.1	Section 01 33 00 - Submittal Procedures.
	.2	Section 01 78 00 – Closeout Submittals.
	.3	Section 01 79 00 – Demonstration and Training.
	.4	Section 26 05 00 – Common Work Results - Electrical.
<u>1.3 Designated Contractor</u>	.1	Hire the services of Interior Instrument Engineering Services (IIES) to do the work of this section.
	.2	IIES Contact Information: 1115 St Paul Street, Kelowna, B.C. V1Y 2C6. Tel (250) 717 8813
<u>1.4 References</u>	.1	Canadian Standards Association (CSA):
	.1	CSA C22.2 No.14, Industrial Control Equipment.
	.2	CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
	.2	National Electrical Manufacturers Association (NEMA).
	.1	NEMA ICS 1, Industrial Control and Systems: General Requirements.
	.3	Canadian Electrical Code (latest edition).
	.4	Electrical sheets E02 to E10, Detailed Kiosk Drawings
	.5	Electrical sheets E11 to E16, Control Panel Drawings.
<u>1.5 Submittals</u>	.1	Include schematic, wiring, interconnection diagrams.
	.2	Submit shop drawings and product data in accordance with Section 26 05 00 – Common Work Results-Electrical.
<u>1.6 Quality Assurance</u>	.1	Submit to Departmental Representative one copy of test results.

PART 2 - MATERIALS

- | | | | |
|-------|-------------------------------------|----|--|
| 2.1 | General | .1 | For each type of controls and instrumentation equipment, use products of one manufacturer throughout the project. |
| <hr/> | | | |
| 2.2 | Control Cables | .1 | Individual control cables: stranded annealed copper conductors, 18AWG, with PVC insulation type TW -40 C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jacket. |
| | | .2 | Stranded control cables to be terminated with crimp on pins prior to insertion in terminal blocks. |
| | | .3 | 2 conductor control wiring colour scheme: Red conductor indicates positive connection. Black conductor indicates negative connection. |
| | | .4 | Multiconductor cables: Type LVT, #20AWG minimum, thermoplastic insulation, outer covering of thermoplastic jacket. |
| | | .5 | Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring. |
| 2.3 | Programmable Logic controller (PLC) | .1 | Included Components: <ul style="list-style-type: none"> .1 Uninterrupted Power Supply (UPS). .2 CPU Module. .3 AC Input Modules. .4 Relay Output Modules .5 Isolated Relay Output Modules .6 Analog Input Module |
| | | .2 | PLC controls based on City of Penticton standards. |
| 2.4 | Station Communication | .1 | To be provided via radio transmission compliant with the City of Penticton telemetry system. |
| | | .2 | Radio Link <ul style="list-style-type: none"> .1 Hardware and system layout as per electrical drawings. .2 Supply and install all cables, lightning protection / arrestor, connectors, stainless steel mounting bracket. |

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- .3 Confirm distance and topography with radio system manufacturer, and as necessary supply (and assume costs for) signal path testing prior to construction.
 - .4 Coordinate with the City of Penticton to obtain a radio licence.
 - .5 Installation
 - .1 Refer to drawing sheet E10 for antenna details.
 - .2 Antenna feeder cable to be non-spliced.
 - .1 Minimum standard
 - .1 Schneider TBUM29729X
 - .6 Control System integrator shall configure station and integrate with City of Penticton Plant Control System (PCM)
 - .3 The monitoring system shall be capable of transmitting the following signals and alarms to the monitoring station:
 - .1 Pump 1, 2 On/Off Cycles.
 - .2 Pump 1, 2 Runtimes.
 - .3 Pump 1, 2 Current Draw.
 - .4 Pump 1, 2 In Auto.
 - .5 Pump 1, 2 In Manual.
 - .6 Pump 1, 2 Overload/Trip.
 - .7 Pump 1, 2 Start.
 - .8 Pump 1, 2 Stop.
 - .9 Pump 1, 2 Seal Leak failure, Over-Temperature.
 - .10 Pump 1, 2 Motor Current – continuous.
 - .11 Pump 1, 2 run time – continuous.
 - .12 Pump 1, 2 Number of starts.
 - .13 Pump station totalized daily flow.
 - .14 High/Low Level Floats and Transducer based.
 - .15 Voltage Monitor.
 - .16 Ventilation system failure.
 - .17 Submersible transmitter failure.

- .18 Cellular signal strength / communications failure.
 - .19 Historic log showing alarm history.
 - .20 Graphing of historic data exportable to Microsoft Word or Excel.
 - .21 Crew On-Site notification alert.
 - .22 Low battery back-up alarm.
 - .23 Wet well continuous level.
 - .24 Loss of utility power.
 - .25 Generator fault.
 - .26 Flow Rate and Total Flow
- 2.5 Uninterrupted Power Supply (UPS)
-
- .1 Minimum Standard:
 - .1 Always On "N" Series.
 - .2 Equipment Characteristics:
 - .1 True online type (continuous rectification & inversion)
 - .2 80-140 VAC, 50-60 Hz input
 - .3 120 VAC, 700 watt, 1000 VA, 60 Hz sine wave output, +/- 3%
 - .4 7 minute backup time at full load, 20 minutes at half load.
 - .5 Complete with optional relay output card with contacts rated 3A @ 250VAC for "Inverter Bypass", "Battery Low", "Backup" and "Fault" conditions.
- 2.6 AC Control Relays
-
- .1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.
 - .2 Convertible contact type: contacts field convertible from NO to NC, electrically held, with solid state timer as indicated. Coil rating: as indicated. Contact rating: as indicated.
 - .3 Sealed contact type: electrically held. Coil rating: as indicated. Contact rating: as indicated.
 - .4 Universal pole type: electrically held convertible from NO to NC by changing wiring connections. Coil rating: as indicated. Contact rating: as indicated.
 - .5 Fixed contact plug-in type: general purpose low coil current. Coil rating: as indicated. Contact rating: as indicated.

	.6	Socket bases and DIN mounting rails for plug-in type relays.
2.7 Relay Accessories	.1	Standard contact cartridges: normally-open - convertible to normally-closed in field.
2.8 Solid State Timing Relays	.1	Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.
	.2	Operation: on-delay or off-delay.
	.3	Potentiometer: self contained to provide time interval adjustment.
	.4	Supply voltage: 120 or 24 V, AC, 60 Hz, as indicated.
	.5	Temperature range: minus 20 degrees C to 60 degrees C.
	.6	Output contact rating: maximum voltage 300 V AC or DC. Current: NEMA ICS 1 as indicated.
	.7	Timing ranges: minimum 0.5 maximum 60s.
2.9 Instantaneous Trip Current Relays	.1	Enclosure: CSA Type 1.
	.2	Contacts: NO, NC automatic reset with adjustable tripping point.
	.3	Control: 3 wire, with provision for shorting contacts during accelerating period of motor.
	.4	Contact rating: NEMA ICS 1 as indicated.
2.10 Operator Controls Station	.1	Enclosure: CSA Type 1, surface mounting.
2.11 Pushbuttons	.1	Illuminated, Standard duty. Operator recessed mushroom type, as indicated, with 1-NO and 1-NC auxiliary contacts rated as indicated. Labels as indicated. Stop pushbuttons coloured red, provision for padlocking in depressed position and labelled "emergency stop".
2.12 Selector Switches	.1	Maintained 2 or 3 position labelled as indicated standard duty, operators wing lever, contact arrangement as indicated, rated as indicated.
2.13 Indicating Lights	.1	Standard duty, full voltage, transformer LED type, push-to-test, lens colour: as indicated, supply voltage as indicated, labels as indicated.

2.14 Control and Relay Panels	.1	CSA Type 1 sheet steel enclosure (sprinkler proof where required) with hinged padlockable access door, accommodating relays, timers, labels, as indicated, factory installed and wired to identified terminals.
2.15 Control Circuit Transformers	.1	Single phase, dry type.
	.2	Primary: 208, 240 or 600 V, 60 Hz ac.
	.3	Secondary: 120 V, or 24V ac.
	.4	Rating: 50, 150, 250, 350 or 500 VA, as indicated.
	.5	Secondary fuse: size as required.
	.6	Close voltage regulation as required by magnet coils and solenoid valves.
2.16 Thermostat (Line Voltage)	.1	Wall mounted, for exhaust fan control.
	.2	Full load rating: Amps as indicated at 120 V
	.3	Temperature setting range: 10 degrees C to 30 degrees C.
	.4	Thermometer Range: 10 degrees C to 30 degrees C.
	.5	Markings in 5 degrees increments.
	.6	Differential temperature fixed at 20 degrees C.
2.17 Magnetic Flowmeter	.1	Transmitter
	.1	Minimum Standard
	.1	Siemens SITRANS FM MAG 5000
	.2	Sensor
	.1	Minimum Standard
	.1	Siemens SITRANS FM MAG 5100W
2.17 Kiosk	.1	Three compartment kiosk, powder coated aluminium, insulated.
	.2	All control and telemetry equipment on the front panel and all power equipment on the rear panel.
	.3	Contain a wet well ventilation fan, explosion proof motor.
	.1	Two speed fan
	.1	10 air changes per hour, continuous.
	.2	20 air changes per hour, manual adjust.
	.2	Co-ordinate with Section 32 32 13.13 for fan sizing.
	.4	Refer to sheets E02-E10 for details.

PART 3 - EXECUTION

- 3.1 General
 - .1 It is the responsibility of the Division 26 subcontractor to verify final requirements for wiring of all equipment noted. Verification of wiring requirements to include:
 - .1 confirmation of electrical characteristics.
 - .2 location of connection point.
 - .3 method of connection (i.e. direct or plug in etc.).
 - .2 Obtain and become familiar with shop drawings for all relevant equipment.
 - .3 Install pushbutton stations, control and relay panels, control devices and interconnect as required on control wiring diagrams as per drawings.
 - .4 No claim for extra work will be entertained for wiring equipment which has been indicated, or changes to installed wiring where installation proceeded prior to verification of electrical requirements.

- 3.2 Installation of control Cables
 - .1 Install control cables in liquid tight plastic conduit, secured to wall or ceiling at intervals not to exceed 1 meter:
 - .1 Maximum conduit fill 30%.
 - .2 Ground control cable shield.

- 3.3 Field Quality Control
 - .1 Calibrate and field test all controls and instrumentation equipment for accuracy and performance. Provide testing equipment and manpower necessary for this verification.
 - .2 Perform tests in accordance with this section as noted, Section 26 05 00 – Common Work Results – Electrical, and Section 01 79 00 – Demonstration and Training.
 - .3 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.
 - .4 Testing to include a radio system verification.

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- .5 Upon completion of sectional test, undertake group testing
 - .6 Check out complete system for operational sequencing.
 - .7 Prepare report detailing tests performed and results obtained to Section 01 78 00 – Closeout Submittals.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 26 05 00 – Common Work Results - Electrical

1.2 Reference

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 100 – Motors and Generators
 - .2 ANSI/NEMA MG-1 – Motors and Generators.
 - .3 Canadian Electrical Code and BC Amendments.
 - .4 CSA C282 – Emergency Electrical Power Supply for Buildings.
- .2 International Organization for Standardization (ISO)
 - .1 ISO 3046-01, Reciprocating Internal Combustion Engines - Performance - Part 1: Declarations of Power, Fuel and Lubricating Oil Consumptions, and Test Methods.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 ULC-S601, Standard for Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids.

1.3 Description

- .1 Work specified in this Section includes:
 - .1 Diesel engine generator complete with auxiliary equipment for use as an emergency and standby source of power.
 - .2 Outdoor Weatherproof Enclosure.
- .2 The equipment manufacturer(s) and the authorized supplier shall have complete responsibility for the performance of the engine generator set and its accessories.
- .3 Provide all necessary controls and accessories to make a complete operating system.
- .4 Generator set consists of:
 - .1 Diesel engine.
 - .2 Alternator.
 - .3 Alternator control panel.
 - .4 Automatic transfer equipment.
- .5 Battery charger and battery.
- .6 Automatic engine room ventilation system.
- .7 Fuel supply system.

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- .1 Fuel lines and fittings.
 - .2 Day tank.
 - .8 Exhaust system.
 - .9 Structural steel mounting base.
 - .10 Synchronizing panel (as indicated)
 - .11 Manual by-pass isolation switch.
 - .12 System designed to operate as emergency standby unattended.

1.4 Shop Drawings

- .1 Submit shop drawings as follows:
 - .1 Engine: make and model, with performance curves.
 - .2 Alternator: make and model.
 - .3 Voltage regulator: make, model and type
 - .4 Battery: make, type and capacity.
 - .5 Battery charger: make, type and model.
 - .6 Alternator control panel: make and type of meters and controls.
 - .7 Governor type and model.
 - .8 Dimensioned drawing showing complete generation set mounted on steel base, including exhaust system and total weight.
 - .9 Continuous full load output of set at 1.0 pf lagging.
 - .10 Description of set operation including:
 - .1 Manual starting, including time in seconds from start of cranking until unit reaches rated voltage and frequency.
 - .2 Automatic shut down on: overcranking, overspeed, high engine temperature, low lube oil pressure, and alternator overvoltage.
 - .3 Alarms and indication lights.
 - .11 Outdoor Weatherproof Enclosure: layout and details.

1.5 Operation and Maintenance Data

- .1 Supplier shall furnish 3 set(s) of operating maintenance and parts manuals for equipment furnished.
- .2 Operation and maintenance instructions for engine, alternator, control panel, manual starting switch, battery charger, battery, fuel system, exhaust system, kiosk and accessories, to permit effective operation, maintenance and repair.
- .3 Technical data:
 - .1 Illustrated parts list with parts catalogue numbers.
 - .2 Schematic diagram of electrical controls.

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- .3 Cooling system
 - .4 Certified copy of factory test results, to be supplied prior to equipment shipping to site.
- 1.6 Quality Control
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- .1 Factory test generator set including engine, alternator, control panels and accessories. Factory test shall include running generator set for four hours at 100% rated load.
 - .2 Tests:
 - .1 Manual starting of set.
 - .2 Single-step load pickup.
 - .3 Transient and steady-state governing.
 - .4 Safety shutdown device testing and alarm testing.
 - .5 Voltage regulation.
 - .6 Rated power and maximum power.
- 1.7 Warranty
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- .1 Provide a written warranty stating that the generating set is warranted against defects in material and workmanship for a period of 24 months, or 1500 operating hours, whichever occurs first, from date of substantial completion.
- 1.8 Maintenance Materials
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- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Include:
 - .1 2 fuel filter replacement elements.
 - .2 2 lube oil filter replacement elements.
 - .3 2 air cleaner filter elements.
 - .4 2 sets of fuses for control panel.
 - .5 Special tools for unit servicing.
- 1.10 Training
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- .1 Provide training in accordance with Section 01 79 00 – Demonstration and Training.
 - .2 Arrange and pay for on-site lectures and demonstrations by system manufacturer to train designated personnel in the use and maintenance of the generator set and transfer switch.

PART 2 - PRODUCTS

2.1 Diesel Engine

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- .1 Diesel engine: to ISO 3046-1.
 - .1 Engine: standard product of current manufacture, from company regularly engaged in production of such equipment.
 - .2 Naturally aspirated, synchronous speed 1800 r/min, or as indicated.
 - .3 Capacity:
 - .1 Rated continuous power in kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows: Rated continuous output = Generator kW divided by Generator efficiency at full load.
 - .1 Under following site conditions:
 - .1 Altitude: as indicated in m.
 - .2 Ambient temperature: as indicated in degrees C.
 - .3 Relative humidity: as indicated in %.
 - .2 Engine overload capability 110% of continuous output for 1 hour within 12 hours period of continuous operation.
 - .2 Engine overload capability 110% of continuous output for 1 hour within 12 hours period of continuous operation.
 - .4 Cooling System:
 - .1 Air cooled: air cooling duct enveloping cylinder walls with pressure cooling by engine driven blower.
 - .2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40 degrees C.
 - .5 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start in room ambient 0 degrees C.
 - .1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from line side of automatic transfer switch.
 - .6 Fuel system: solid injection, mechanical fuel transfer pump, fuel filters and air cleaner, fuel rack solenoid energized when engine running.
 - .7 Lubricating System:
 - .1 Pressure lubricated by engine driven pump.
 - .2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.
 - .3 Lube oil cooler.
 - .4 Engine sump drain valve.

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- .8 Governor: precision type electrical – electronic.
 - .9 Starting System:
 - .1 Positive shift, gear engaging starter 12 or 24V dc.
 - .2 Cranking limiter to provide 3 cranking periods of 10s duration, each separated by 5 s rest.
 - .3 Lead acid, 12 or 24V storage battery with sufficient capacity to crank engine for 1min at 0 degrees C without using more than 25% of ampere hour capacity.
 - .4 Battery charger: constant voltage, solid state, two stage from trickle charge at standby to boost charge after use. Capable of recharging a completely discharged battery to 80% of capacity within 4 hours and to full capacity in less than 12 hours. Automatic boost for 6h every 30 days. Equipped with dc voltmeter, dc ammeter and on-off switch.
 - .10 Vibration isolated engine instrument panel with:
 - .1 Lube oil pressure gauge.
 - .2 Lube oil temperature gauge.
 - .3 Lube oil level gauge.
 - .4 Coolant temperature gauge.
 - .5 Coolant level gauge.
 - .6 Running time meter: non-tamper type.
 - .11 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.
 - .12 Drip tray.

2.2 Alternator

- .1 Alternator: to ANSI/NEMA MG1
- .2 Rating: 1phase, 60Hz, at 1.0PF, 240 volts, 10 kW
- .3 Output at 40 degrees C ambient:
 - .1 100% full load continuously.
 - .2 110% full load for 1h.
 - .3 150% full load for 1 min.
- .4 Revolving field, brushless, single bearing.
- .5 Drip proof.
- .6 Amortisseur windings.
- .7 Synchronous type.
- .8 Dynamically balanced rotor permanently aligned to engine by flexible disc

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- coupling.
 - .9 Exciter: rotating brushless.
 - .10 NEMA class H insulation on windings.
 - .11 Thermistors embedded in stator winding and connected to alternator control circuitry.
 - .12 Voltage Regulator: solid state type
 - .1 Stability: 3% during no load to full load.
 - .2 Regulation: 1% at steady state
 - .13 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.
- 2.3 Control Panel
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- .1 Totally enclosed, engine mounted, mounting base isolated from diesel generator.
 - .2 Minimum Standard:
 - .1 Panelmate.
 - .3 Instruments:
 - .1 Analogue or Digital LCD Display, as indicated, to display the following:
 - .1 AC voltage, frequency and amperage.
 - .2 Battery voltage.
 - .3 Hour meter.
 - .4 Fuel level.
 - .5 Lube oil pressure.
 - .6 Coolant temperature.
 - .4 Controls:
 - .1 Engine start button.
 - .2 Selector switch: Off-Auto-Manual.
 - .3 Engine emergency stop button and provision for remote emergency stop button.
 - .1 Alternator output breaker:
 - .1 Circuit breaker: bolt-on, moulded case, temperature compensated for 40 degrees C ambient, dual thermal-magnetic trip.
 - .2 Circuit breaker, solid state sensing with:

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- .1 Frame containing breaker contacts, arc quenchers, manual mechanism, quick- make, quick-break, spring-loaded overcenter switching mechanism, mechanically trip free from handle, fixed type.
 - .2 Static sensor: current monitors detect overload, short-circuit and ground-fault currents, and send these signals through solid-state circuits to static sensor which acts to trip breaker. Adjustable for current values and time of tripping.
 - .3 Flux-transfer shunt trip- magnetic tripping device actuated by signal from static sensor to open breaker contacts. Requires no external source of power.
 - .2 Voltage control rheostat: mounted on inside of control panel.
 - .3 Operating lights, panel mounted:
 - .1 "Normal power" pilot light.
 - .2 Emergency power" pilot light.
 - .3 Green pilot lights for breaker on and red pilot lights for breaker off.
 - .4 Solid state indicator lights for alarm with 2 sets manually reset NO/NC contacts wired to terminal block for remote annunciation on:
 - .1 Low fuel level.
 - .2 Low battery voltage.
 - .3 Ventilation failure.
 - .4 Low coolant temperature.
 - .5 Sub-base fuel tank leakage.
 - .5 Solid state controller for automatic shutdown and alarms with 2 sets manually reset NO/NC contacts wired to terminal block for remote annunciation on:
 - .1 Engine overcrank.
 - .2 Engine overspeed.
 - .3 Engine high temperature.
 - .4 Engine low lube oil pressure.
 - .5 Short circuit.
 - .6 AC over voltage.

	.6	Lamp test button.
	.7	Synchronization and load sharing.
	.8	Provision for remote monitoring.
	.9	Dry contact outputs shall be rated up to 230VAC for running and fault status monitoring.
2.4 Automatic Transfer Switch	.1	Refer to Section 26 36 23 – Automatic Transfer Switches.
2.5 Manual Bypass Isolation Switch	.1	Load break bypass and isolation switch: manually operated, double throw, to provide bypass around transfer switch to facilitate maintenance on diesel generator control panel and transfer switch. Switch lockable in bypass position. Refer to Section 26 36 23 – Automatic Transfer Switches.
2.6 Steel Mounted Base	.1	Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.
	.2	Assembly fitted with vibration isolators.
	.1	Spring type isolators with adjustable side snubbers and adjustable for levelling.
	.3	Sound insulation pads for installation between isolators and concrete base.
2.7 Exhaust System	.1	Heavy duty industrial type horizontally mounted exhaust silencer with condensate drain, plug and welded 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	Day tank:
	.1	Capacity as required to run for 24hrs at full load, mounted on sub-base integral to generator enclosure.
	.2	Dual walled with capacity for remote monitoring of leakage.
2.9 Outdoor	.1	Outdoor steel weatherproof enclosure to protect the entire generator set.

<p>Weatherproof Enclosure</p> <hr/>	<p>The enclosure shall be weatherproof, vandal proof, and provide sound attenuation.</p> <p>.2 Enclosure shall allow for necessary combustion and cooling air required for the generator set.</p> <p>.3 Enclosure shall have lockable hinged side access doors to allow maintenance access to the engine/generator and lockable hinged rear door to provide access to the control panel. Doors shall have locking handles (common key) with stainless steel hinges. Lift-out panels are not acceptable.</p> <p>.4 Enclosure sheet metal shall be #5052 marine-grade aluminium, primed and painted with manufacturer’s standard colours.</p> <p>.5 Enclosure openings shall be provided with vermin resistant screens.</p> <p>.6 Air silencers shall be provided at the radiator air discharge (if required) to reduce noise level to 65 dBA at 10.0 meters from the generator air discharge louvers with full load applied.</p> <p>.7 Exhaust mufflers shall be provided to reduce noise level to 65 dBA at 7.0 meters from the exhaust pipe discharge location with full load applied.</p> <p>.8 Enclosure shall be equipped with 120 VAC light and receptacle for servicing (to be fed from maintained supply).</p>
<p>2.10 Source Quality Control</p> <hr/>	<p>.1 Factory test generator set including engine, alternator, control panels, transfer switch and accessories.</p> <p>.2 Provide certified copy of test results to Department Representative prior to shipping of equipment to site and incorporate into Commissioning Manual specified in Section 01 78 00 – Closeout Submittals.</p> <p>.3 Demonstrate:</p> <ul style="list-style-type: none"> .1 Automatic starting of set and automatic transfer of load on failure of normal power. .2 Operation of manual bypass switch. .3 Automatic shut down of engine on resumption of normal power. .4 That battery charger reverts to high rate charge after cranking. <p>.4 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.</p>

PART 3 - EXECUTION

3.1 Installation

- .1 Locate generating unit and install as indicated.
- .2 Install pushbutton stations, control and relay panels, control instrumentation devices and interconnect as shown on drawings.
- .3 Install all equipment in exact accordance with manufacturer’s instructions and as shown on drawings.

3.2 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 79 00 – Demonstration and Training.
- .2 Notify Department Representative 10 working days in advance of test date.
- .3 Provide fuel for testing and leave fuel tanks full on acceptance.
- .4 Demonstrate:
 - .1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.
 - .2 Unit start and shut down on "Manual" control
 - .3 Unit start and transfer on "Test" control.
 - .4 Unit start on "Engine start" control.
 - .5 Operation of manual bypass switch.
 - .6 Operation of automatic alarms and shut down devices.
- .5 Run unit on load for minimum period of 4 hours to show load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling.
- .6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state. Leave fuel tanks full on completion of tests.
- .7 Provide full test report to the Department Representative on completion.

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 standby generator unit, transfer loads and shut down standby unit.
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1.2	Related Sections	.1	Section 01 33 00 - Submittal Procedures.
		.2	Section 01 78 00 – Closeout Submittals.
		.3	Section 01 79 00 – Demonstration and Training.
		.4	Section 26 05 00 – Common Work Requirements - Electrical.
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1.3	References	.1	Canadian Standards Association (CSA):
		.1	CAN3-C13, Instrument Transformers.
		.2	CSA C22.2 No.5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).
		.3	CSA C22.2 No.178, Automatic Transfer Switches.
		.2	American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)
		.1	ANSI/NEMA ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
		.3	Canadian Electrical Code and BC Amendments.
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1.4	System Description	.1	Automatic load transfer equipment to:
		.1	Monitor voltage on phases of normal power supply.
		.2	Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase 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 phases above adjustable pre-set limit for adjustable time period.
- .5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

1.5 Submittals

- .1 Include:
 - .1 Make, model and type.
 - .2 Load classification:
 - .1 Tungsten lamp load: as indicated in kW.
 - .2 Ballast lamp load: as indicated in kW.
 - .3 Motor load: as indicated in kW.
 - .4 Restricted use: resistance and general loads, 0.8pf or higher as indicated in kW.
 - .3 Single line diagram showing controls and relays.
 - .4 Description of equipment operation including:
 - .1 Automatic starting and transfer to standby unit and back to normal power.
 - .2 Test control.
 - .3 Manual control.
 - .4 Automatic shutdown.

1.6 Closeout Submittals

- .1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 01 78 00 - 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 - PRODUCTS

- | | | | | |
|-----|---|----|---|---|
| 2.1 | Materials | .1 | Instrument transformers: to CAN3-C13. | |
| | | | .2 | Contactor: to ANSI/NEMA ICS2. |
| | | | .3 | Minimum Standard: |
| | | | .1 | Minimum Thompson Technologies TS870 series |
| 2.2 | Contactor Type
Transfer
Equipment | .1 | Contact Type Transfer Equipment: to CSA C22.2 No.178. | |
| | | | .2 | Two- single phase contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, motor operated, with CSA sprinkler proof enclosure, as indicated. |
| | | | .3 | Rated: as indicated on electrical drawings. |
| | | | .4 | Main contacts: silver surfaced, protected by arc disruption means. |
| | | | .5 | Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors. Provide complete bypass – isolation type switch. |
| | | | .6 | Auxiliary contact: silver plated, to initiate emergency generator start-up on failure of normal power. |
| | | | .7 | Fault withstand rating: as required in kA. |
| | | | .8 | Lever to operate switch manually when switch is isolated. |
| | | | .9 | Solid neutral bar, rated: as indicated. |
| | | | .10 | Overlapping neutral contacts on contactor type transfer equipment. |
| | | | .11 | Solid state electronic in phase monitor as indicated. |
| 2.3 | Controls | .1 | Selector switch - four 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 |

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- shuts down engine.
 - .3 Manual position - Transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.
 - .4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.
 - .2 Control transformers: dry type with 120V 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: one phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2V minimum undervoltage and over voltage protection.
 - .2 Time delay: normal power to standby, adjustable solid state, 0 to 60s.
 - .3 Time delay on engine starting to override momentary power outages or dips, adjustable solid state, 0 to 60s delay.
 - .4 Time delay on retransfer from standby to normal power, adjustable 0-60s.
 - .5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable solid state, 5s intervals to 180s.
 - .6 Time delay during transfer to stop transfer action in neutral position to prevent fast transfer, adjustable, 5s intervals to 180s.
 - .7 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.
 - .4 Solid state electronic in-phase monitor as indicated.

2.4 Accessories

- .5 Switchable neutral pole on circuit breaker type equipment.
- .1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.
- .2 Plant exerciser: 168h timer to start standby unit once each week for selected interval but does not transfer load from normal supply. Timer adjustable 0-168h in 15 min intervals.
- .3 Auxiliary relay to provide 1 N.O. and 1 N.C. contacts for remote alarms.
- .4 Instruments:
 - .1 Analogue or Digital true rms, indicating type 2% accuracy, flush panel mounting:
 - .1 Voltmeter: ac, scale 0 to 600 V as indicated.
 - .2 Ammeter: ac, scale 0 to 200 A as indicated.
 - .3 Frequency meter: scale 55 to 65 Hz.
 - .5 Voltmeter selector switch: rotary, maintained contacts, panel mounting type, round notched handle, four position, labelled "OFF-Phase A-Phase B-Phase C".
 - .6 Potential transformers - dry type for indoor use:
 - .1 Ratio: 600 to 120.
 - .2 Rating: 600 V, 60Hz, BIL 5 kV.
 - .3 Accuracy rating: 2%.
 - .7 Ammeter selector switch: rotary, maintained contacts, panel mounting type, designed to prevent opening of current circuits, round notched handle, four position labelled "OFF - Phase A - Phase B - Phase C".
 - .8 Current transformers - dry type for indoor use:
 - .1 Ratio: as indicated.
 - .2 Rating: 600 V, 60Hz, BIL 5 kV.
 - .3 Accuracy rating: 2%.
 - .4 Positive action automatic short- circuiting device in secondary terminals.
 - .9 Manual bypass: c/w unit to isolate switch for maintenance purposes.
 - .10 Generator fault alarm, dry contact relay.

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|-----|-----------------------------|----|---|
| 2.5 | Equipment
Identification | .1 | Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical. |
| | | .2 | Control panel: |
| | | .1 | For selector switch and manual switch: size 5 nameplates. |
| | | .2 | For meters, indicating lights, minor controls: size 3 nameplates. |
| | | .3 | Nameplates to include: voltage, amperage and # of phases. |
| 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. |
| | | .3 | Provide copy of test reports and include with Commissioning Manual as per Section 01 78 00 – Closeout Submittals and Section 01 79 00 – Demonstration and Training. |

PART 3 - EXECUTION

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|-----|--------------------------|----|--|
| 3.1 | Installation | .1 | Locate, install and connect transfer equipment. |
| | | .2 | Check relays, solid state monitors and adjust as required. |
| | | .3 | Install and connect battery and remote alarms. |
| 3.2 | Field Quality
Control | .1 | Perform tests in accordance with Section 26 05 00 – Common Work Requirements - Electrical and Section 01 79 00 – Demonstration and Training. |
| | | .2 | Energize transfer equipment from normal power supply. |

- .3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.
- .4 Set selector switch in "Manual" position and check to ensure proper performance.
- .5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.
- .6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.
- .7 Repeat, at 1h intervals, 3 times, complete test with selector switch in each position, for each test.

END OF SECTION

PART 1 - GENERAL

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| <p>1.1 <u>References</u></p> | <p>.1</p> | <p>American Society for Testing and Materials International (ASTM)</p> <p>.1 ASTM C88-13, Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.</p> <p>.2 ASTM C136-14, Method for Sieve Analysis of Fine and Coarse Aggregate.</p> <p>.3 ASTM C117-13, Test Method for Material Finer than 0.075 mm Sieve in Mineral Aggregates by Washing.</p> <p>.4 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.</p> |
| | <p>.2</p> | <p>Canadian Standards Association (CSA International)</p> <p>.1 CSA A23.1/ A23.2-09, Concrete Materials and Methods of Concrete Construction.</p> |
| <p>1.2 <u>Regulations</u></p> | <p>.1</p> | <p>Shore and brace excavations, protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.</p> |
| | <p>.2</p> | <p>Not later than one week before backfilling or filling, provide to designated testing agency, 23 kg sample of backfill or fill materials proposed for use.</p> |
| | <p>.3</p> | <p>Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.</p> |
| | <p>.4</p> | <p>Not later than 48 hours before backfilling or filling with approved material, notify the Departmental Representative so that compaction tests can be carried out by designated testing agency.</p> |
| | <p>.5</p> | <p>Before commencing work, conduct, with the Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.</p> |
| <p>1.3 <u>Tests and Inspections</u></p> | <p>.1</p> | <p>Testing of materials and compaction of backfill and fill will be</p> |

		carried out by a certified testing firm, retained by the Contractor and approved by the Departmental Representative.
1.4 Buried Services	.1	Before commencing work, verify the location of all buried services on and adjacent to the site using ground penetrating radar.
	.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.
1.5 Protection	.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 the Departmental Representative's approval.
	.4	Protect natural and manmade 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.
 PART 2 - PRODUCTS		
2.1 Materials	.1	Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM test procedure C-88 or latest revised issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.
	.2	All crushed gravel when tested according to ASTM C-136 and ASTM C-117, or latest revised issue, to have a generally uniform gradation and conform to following sieve must have one or more fractured faces. Determination of the Ministry of Transportation and

Highways' Specification I-11, Fracture Count for Coarse Aggregate, Method "A", which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.

- .3 Native material to be any workable soil free of organic or foreign matter; any material obtained within limits of Contract may be deemed native material for purposes of payment if it is approved by the Contract Administrator. Native material is not acceptable if it is impracticable to control its water content or compact to specified density.
- .4 Granular Pipe Bedding and Surround Material
Crushed or graded gravels: to conform to following gradation:

Sieve Designation	Percent Passing	
	Type 1*	Type*2
25.0mm	100	100
19.0mm	90 - 100	90 - 100
12.5mm	65 - 85	70 - 100
09.5mm	50 - 75	--- ---
4.75mm	25 - 50	40 - 70
2.36mm	10 - 35	25 - 52
1.18mm	6 - 26	15 - 38
0.600mm	3 - 17	6 - 27
0.300mm	--- ---	3 - 20
0.075mm	0 - 5	0 - 8

*Type 1: standard gradation

*Type 2: to be used only in dry trench conditions and with Departmental Representative's prior approval.

- .5 Top Soil for seeded areas: mixture of articulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture: The Canadian System of Soil Classification, to

consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.

- .2 Contain no toxic elements or growth inhibiting materials.
- .3 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .4 Consistencies: friable when moist.

PART 3 - EXECUTION

3.1 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.

3.2 Clearing and Grubbing

- .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
- .2 Remove stumps and tree roots below footings, slabs, and paving, and to not less than 200 mm below finished grade elsewhere.
- .3 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction.

3.3 Excavation

- .1 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 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.
 - .3 Dispose of topsoil as directed by the Departmental Representative.
- .2 Excavate as required to carry out work, in all materials met. Do not disturb soil or rock below bearing surfaces. Notify the Departmental

-
- Representative when excavations are complete. If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work. Excavation taken below depths shown without Departmental Representative's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .3 Excavate trenches to provide uniform continuous bearing and support for 100 mm thickness of pipe bedding material on solid and undisturbed ground. Trench widths below point 300 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .4 Excavate for slabs and paving to subgrade levels. In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.
- 3.4 Backfilling
-
- .1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by the 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: place backfill to underside of required sub-base and base layers, and compact to following Modified Proctor densities in compliance with ASTM D1557.
- .1 Boulevards and easements to minimum 90%
- .2 Roads, driveways, shoulders, re-shaped ditches and sidewalks to minimum 95%.
- .3 Use caution in pipe zone to ensure no damage to pipe.
- .5 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .6 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.
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	.7	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.
3.5 Contaminated Materials	.1	If contaminated materials are detected during excavation operations, immediately notify the Departmental Representative. Any contaminated materials to be disposed of using methods approved by the Departmental Representative.
3.6 Grading	.1	Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by the Departmental Representative. Grade to be gradual between finished spot elevations shown on drawings.
3.7 Topsoil Placement	.1	Place a minimum of 150 mm of top soil under all areas where grass seeding is indicated on the contract drawings.
	.2	The Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.
3.8 Shortage and Surplus	.1	Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.
	.2	Dispose of surplus material off site.

END OF SECTION

PART 1 - GENERAL

1.1	Section Includes	.1	Materials and installation of polymeric geotextiles used in revetments, breakwaters, retaining wall structures, filtration, drainage structures, roadbeds and railroad beds purpose of which is to:
		.1	Separate and prevent mixing of granular materials of different grading.
		.2	Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.
1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
		.3	Section 31 00 99 – Earthworks for Minor Works
1.3	Measurement Procedures	.1	Measure geotextiles incidental to the works they are a component of.
1.4	References	.1	American Society for Testing and Materials International, (ASTM):
		.1	ASTM D4491-99a(2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
		.2	ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
		.3	ASTM D4716-08(2013), Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
		.4	ASTM D4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
		.2	Canadian General Standards Board (CGSB):
		.1	CAN/CGSB-4.2 No. 11.2-M89(April 1997), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
		.2	CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
		.1	No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
		.2	No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
		.3	No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under

		No Compressive Load
	.4	No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles
	.5	No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size
	.3	Canadian Standards Association (CSA International):
	.1	CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
	.2	CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
	.4	Ontario Provincial Standard Specifications (OPSS):
	.1	OPSS 1860-[March 1998], Material Specification for Geotextiles.
	.5	British Columbia Ministry of Health – British Columbia Onsite Sewage Association:
	.1	Sewerage System Standard Practice Manual – Version 2, 21 September, 2007.
1.5	Submittals	.1 Submit to Departmental Representative 3 copies of mill test data and certificate at least 4 weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittal Procedures.
1.6	Delivery, Storage and Handling	.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.
1.7	Waste Management and Disposal	.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
		.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

PART 2 - PRODUCTS

- 2.1 Material
- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls:
 - .1 Width: 2 m minimum.
 - .2 Length: 200 m minimum.
 - .3 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
 - .2 Physical properties.
 - .1 Thickness: to CAN/CGSB-148.1, No.3, minimum 1.2 mm.
 - .2 Mass per unit area: to CAN/CGSB-148.1, No.2, minimum 155 g/m².
 - .3 Grab tensile strength and elongation: to ASTM D4632.
 - .1 Breaking force: minimum 35 lb, wet condition.
 - .2 Elongation at future: minimum 50%.
 - .4 Puncture; to ASTM D4833: 10 lbs minimum.
 - .6 Trapezoidal tear; to ASTM D4533: 11 lbs minimum.
 - .3 Hydraulic properties:
 - .1 Apparent opening size (AOS): to ASTM D4751, US Sive # 20 minimum and 70 maximum.
 - .2 Permittivity: to ASTM D4491, 100 gal/min/sq ft minimum.
 - .4 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to CAN/CSA G164

PART 3 - EXECUTION

3.1 Installation

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .6 After installation, cover with overlying layer within 4 h of placement.
- .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .8 Place and compact soil layers in accordance with Section 31 00 99 – Earthworks for Minor Works.

3.2 Cleaning

- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

3.3 Protection

- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

PART 1 - GENERAL

1.1	Section Includes	.1	Materials and installation for asphalt concrete pavement for car park areas, driveways to buildings, bikeways and walks or play areas and extruded asphalt concrete curbs.
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1.2	Related Sections	.1	Section 31 00 99 - Earthwork For Minor Works
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1.3	Measurement Procedures	.1	Asphalt concrete pavement including granular base and sub base will be measured in square metres of asphalt surface in place.
		.2	Approximately 100 square meters of asphalt paving are expected within this contract.
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1.4	References	.1	American Association of State Highway and Transportation Officials (AASHTO)
		.1	AASHTO M320 [02], Standard Specification for Performance Graded Asphalt Binder.
		.2	AASHTO R29 [02], Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
		.3	AASHTO T245 [97(2001)], Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
		.2	Asphalt Institute (AI)
		.1	AI MS2, Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.
		.3	American Society for Testing and Materials International, (ASTM)
		.1	ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
		.2	ASTM C117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.

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- .3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131, Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes.
 - .9 ASTM D995, Standard Specification for Mixing Plants for Hot Mixed, Hot Laid Bituminous Paving Mixtures.
 - .10 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - .11 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .12 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .13 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
 - .14 ASTM D5821, Standard Test Method for determining the Percentage of Fractured Particles.
 - .15 ASTM D6307, Standard Test Method for Asphalt content of Hot-Mix Asphalt.
 - .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 16.1 M89, Cutback Asphalts for Road Purposes.
 - .2 CAN/CGSB 16.2 M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

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|-----|-------------------------------|---|
| 1.5 | Submittals | <ul style="list-style-type: none"> .1 Submit product data in accordance with Section 01 33 00 Submittal Procedures. .2 Submit asphalt concrete mix design to Departmental Representative for review. .3 Materials to be tested by a testing laboratory approved by the Departmental Representative at the Contractor's expense. .4 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work. .5 Submit samples in accordance with Section 01 33 00 Submittal Procedures. .6 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work. .7 Submit samples of following materials proposed for use at least 4 weeks prior to commencing work: <ul style="list-style-type: none"> .1 One 5 L container of asphalt cement. |
| 1.6 | Waste Management And Disposal | <ul style="list-style-type: none"> .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/ Demolition Waste Management And Disposal. .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities. .3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material in appropriate on site bins for recycling in accordance with Waste Management Plan. .4 Divert unused asphalt materials from landfill to a local facility as approved by Departmental Representative. .5 Divert unused aggregate materials from landfill to a local facility for reuse as approved by Departmental Representative. .6 Unused protective coating material must be disposed of at an official hazardous material collections site as approved by Departmental Representative. |

- .7 Unused protective coating material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .8 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 Materials

- .1 Granular base and sub base material: to Section 31 00 99 – Earthworks for Minor Works and following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
 - .3 Table:

Sieve Designation	Granular Base	Granular Sub-Base
200 mm	-	-
75 mm	-	100
50 mm	100	
38.1 m	70-100	-
25 mm	-	55-100
19 mm	50-75	-
12.5 mm	-	-
9.5 mm	40-65	-
4.75 mm	30-50	25-100
2.00 mm	-	15-80
0.425 mm	10-30	4-50
0.180 mm	-	-
	3-8	0-8

.4 Granular base aggregates:

.1 Crushed particles: at least 50 % of particles by mass retained on 4.75 mm sieve to have at least 1 freshly fractured face.

.2 Asphalt concrete aggregates:

.3 Aggregates: shall be supplied in accordance with Section 31 05 16 - Aggregate Materials: General and shall meet the following requirements:

.1 Be comprised of all mineral matter passing the sieve designated in the table below in accordance with the test procedure for each individual test.

.2 Be clean, tough, durable, moderately sharp, free from coatings of clay, silt or other deleterious material, and shall contain no clay balls or other aggregations of fine material.

.3 Meeting the gradation requirements in the table below.

Sieve Designation	% Passing Lower Course	% Passing Surface Course	% Passing Sheet Asphalt
37.5 mm	100	-	-
25 mm	80 -100	-	-
19 mm	60-92	-	-
16 mm	-	100	-
12.5 mm	50-85	90-100	100
9.5 mm	40-80	73-90	90-100
4.75 mm	30-65	50-75	55-80
2.36 mm	20-50	35-57	32-64
1.18 mm	15-35	26-45	24-51
0.600 mm	8-30	18-34	17-40
0.300 mm	6-22	10-26	13-29
0.150 mm	3-15	6-17	8-18
0.075 mm	1-7	3-7	4-10

-
- .4 Coarse aggregate: aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136.
 - .5 Do not use aggregates having known polishing characteristics in mixes for surface courses.
 - .6 Sand equivalent of not less than 50% when tested to ASTM D2419.
 - .7 Magnesium Sulphate soundness: to ASTM C88. Max % loss by mass:
 - .1 Coarse aggregate surface course: 12 %.
 - .2 Coarse aggregate lower course: 12 %.
 - .3 Fine aggregate, surface course: 12 %.
 - .4 Fine aggregate, lower course: 12 %.
 - .8 Degradation: Grading B, to ASTM 6928. Max % loss by mass:
 - .1 Coarse aggregate, surface course: 20%.
 - .2 Coarse aggregate, lower course: 20 %.
 - .9 Absorption: to ASTM C127. Max % by mass:
 - .1 Coarse aggregate, surface course: 1.75 %.
 - .2 Coarse aggregate, lower course: 2.00 %.
 - .10 Lightweight particles: to ASTM C12. Max % by mass less than 1.95 relative density:
 - .1 Surface course: 1.5 %.
 - .2 Lower course: 1.5 %.
 - .11 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max% by mass:
 - .1 Coarse aggregate, surface course: 10 %.
 - .2 Coarse aggregate, lower course: 10 %.

.12 Crushed fragments: at least 60 % of particles by mass within each of following sieve designation ranges, to have at least 1 freshly fractured face. Material to be divided into ranges, using methods of ASTM C136.

Passing		Retained on
25 mm	to	12.5 mm
12.5 mm	to	mm

.13 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

.4 Mineral filler:

.1 Shall consist of all mineral matter passing the 0.600 mm sieve and mineral dust shall consist of all mineral matter passing the 0.075 mm sieve

.2 Shall be free from organic matter

.3 Shall be non plastic when tested in accordance with ASTM D 4318, thoroughly dry and free from lumps.

.4 Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.

.5 Mineral filler to be dry and free flowing when added to aggregate.

.5 Anti stripping agent: hydrated lime to ASTM C207. Add lime at rate of approximately 2 3% of dry weight of aggregate.

.6 Water: to approval of Departmental Representative.

.7 Asphalt cement: to CAN/CGSB-16.3, grade 120-150.

.8 Asphalt prime: to CAN/CGSB-16.2, SS-1.

.9 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.

.10 Asphalt tack coat: to CAN/CGSB-16.2, grade SS-1.

2.2 Equipment

- .1 Pavers: mechanical grade controlled and self powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: minimum of two rollers per paver of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Minimum drum diameter: 1200 mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
 - .4 Use only trucks which can be weighed in single operation on scales supplied.
- .5 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass not less than 12 kg and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.
 - .3 Straight edges, 4.5 m in length, to test finished surface.

2.3 Mix Design

- .1 Mix design to be provided by Contractor and shall be stamped by a professional engineer registered in the province of British Columbia
- .2 Mix design shall be submitted and approved by Departmental Representative.
- .3 Mix design to be developed by testing laboratory approved by Departmental Representative.
- .4 Design of mix: by Marshall method to requirements below.

- .1 Compaction blows on each face of test specimens: 75.
- .2 Mix physical requirements:

Property	Requirements
Marshall Stability (KN) (min)	9.0
Marshall Flow (0.25mm units)	8 - 16
Air Voids (%)	2.5 – 4.5
Voids in Mineral Aggregate (%)	13.5 - 15.0
Voids Filled with Asphalt (%)	65 -75
Film Thickness (µm)	8.0

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to AASHTO T245.
 - .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128. Make allowance for volume of asphalt absorbed into pores of aggregate.
 - .3 Air voids: to ASTM D3203.
 - .4 Voids in mineral aggregates: to AI MS2, chapter 4.
 - .5 Index of Retained Stability: measure in accordance with Marshall Immersion Test for Bitumen.
- .4 Do not change job mix without prior approval of Departmental Representative. When change in material source proposed, new job mix formula to be submitted for approval by Departmental Representative.

PART 3 - EXECUTION

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| 3.1 | Subgrade Surface Preparation And Inspection | .1 | Verify grades of subgrade drains and other items set in paving area for conformity with elevations and sections before placing granular base material. |
| | | .2 | Obtain approval of subgrade of Departmental Representative before placing granular base. |
| | | .3 | Back-filling to subgrade levels to be in accordance with Section 31 00 99 – Earthworks for Minor Works. |
| 3.2 | Granular Base And Granular Subbase | .1 | Place granular base and sub-base material on clean unfrozen surface, free from snow and ice. |
| | | .2 | Place granular base and sub-base to compacted thicknesses as indicated. Do not place frozen material. |
| | | .3 | Place in layers not exceeding 150 mm compacted thickness. Compact to density not less than 95 % of Modified Proctor to ASTM D1557. |
| | | .4 | Finished base surface to be within 10 mm of specified grade, but not uniformly high or low. |
| 3.3 | Asphalt Prime | .1 | Emulsified asphalt: <ul style="list-style-type: none"> .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative. .2 Apply diluted asphalt emulsion at rate directed by Departmental Representative but do not exceed 5 L/m². .3 Apply on damp surface unless otherwise directed by Departmental Representative. |
| | | .2 | Do not apply prime when air temperature is less than 5 °C or when rain is forecast within 2 hours. |
| | | .3 | If asphalt prime fails to set within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material. |

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| 3.4 | Plant And Mixing Requirements | .1 | To ASTM D995. |
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| 3.5 | Asphalt Concrete Paving | .1 | Obtain approval of primer from Departmental Representative before placing asphalt mix. |
| | | .2 | Place asphalt mix only when base or previous course is dry and air temperature is above 5°C. |
| | | .3 | Place asphalt concrete in compacted layers not exceeding 50 mm. |
| | | .4 | Minimum 135°C mix temperature required when spreading. |
| | | .5 | Maximum 160°C mix temperature permitted at any time. |
| | | .6 | Compact each course with roller as soon as it can support roller weight without undue cracking or displacement. |
| | | .7 | Compact parking lot and driveway asphalt concrete to density not less than 95 % of density obtained with Marshall specimens prepared in accordance with ASTM D1559, ion from samples of mix being used. Roll until roller marks are eliminated. |
| | | .8 | Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement. |
| | | .9 | Moisten roller wheels with water to prevent pick up of material. |
| | | .10 | Compact mix with hot tampers or other equipment approved by Owner’s Representative in areas inaccessible to roller. |
| | | .11 | Finish surface to be within 10 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m. |
| | | .12 | Repair areas showing checking, rippling or segregation as directed by Owner’s Representative. |

- 3.6 Joints

 - .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
 - .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
 - .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
 - .4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50 mm.

- 3.7 Asphaltic Curbs

 - .1 Form asphalt curbs by machine to profiles as indicated. Curve curbs uniformly.

- 3.8 Testing

 - .1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory. Refer to Section 01 45 00 - Quality Control.

- 3.9 Protection

 - .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38°C. Do not permit stationary loads on pavement until 24 hours after placement.
 - .2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

END OF SECTION

PART 1 - GENERAL

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| 1.1 | Section Includes | .1 | Materials and installation for chain link fences and gates. |
| | | .2 | Sustainability requirements for construction, verification and operation. |
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| 1.2 | References | .1 | American Society for Testing and Materials International (ASTM) |
| | | .1 | ASTM A53/A53M- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless. |
| | | .2 | A653/A653M- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. |
| | | .3 | ASTM F1664- Standard Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain-Link Fence. |
| | | .4 | ASTM B209M-07, Standard Specification for Aluminium and Aluminium Alloy Sheet and Plate. |
| | | .2 | Canadian Standards Board (CGSB) |
| | | .1 | CAN/CGSB-138.1- Fabric for Chain Link Fence. |
| | | .2 | CAN/CGSB-138.2- Steel Framework for Chain Link Fence. |
| | | .3 | CAN/CGSB-138.3- Installation of Chain Link Fence. |
| | | .4 | CAN/CGSB-1.181- Ready-Mixed Organic Zinc-Rich Coating. |
| | | .3 | Canadian Standards Association (CSA International) |
| | | .1 | CSA A23.1/ A23.2 09, Concrete Materials and Methods of Concrete Construction/Methods of test for Concrete. |
| | | .2 | CAN/CSA-G164- Hot Dip Galvanizing of Irregularly Shaped Articles. |
| | | .3 | CSA G42-1964(R1998), Galvanized (Zinc-Coated) Steel Farm-Field Wire Fencing. |
| | | .4 | CAN/CSA-A3000- Cementitious Materials Compendium.
Includes: |
| | | .1 | CAN/CSA-A23.5- Supplementary Cementing Materials. |
| | | .4 | The Master Painters Institute (MPI): |

		.1	Architectural Painting Specification Manual - 2010.
	.5	American Architectural Manufacturers Association (AAMA):	
		.1	AAMA 2603 – Specifications for powder coated aluminium.
1.3	Related Sections	.1	Section 01 11 05 - General Instructions.
		.2	Section 01 33 00 - Submittal Procedures.
		.3	Section 01 35 33 - Health and Safety Requirements.
		.4	Section 01 35 43 – Environmental Procedures
		.5	Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
		.6	Section 03 30 00 – Cast-in-Place Concrete.
		.7	Section 31 00 99 – Earthworks for Minor Works.
1.4	Submittals	.1	Submittals to be in accordance with Section 01 33 00.
		.2	Submit manufacturer’s data sheets including:
		.1	Fence fabric gauge and finish.
		.2	Post and rail dimensions and finish.
		.3	Gate frame dimension and finish.
		.4	Required fittings and hardware.
		.3	Manufactures specifications for all proposed fence materials to be submitted to departmental representative prior to construction.
		.4	Manufacturer's instructions, printed product literature and data sheets for signage, including product characteristics, performance criteria, physical size, finish and limitations.
1.5	Health and Safety	.1	Do construction occupational health and safety in accordance with Section 01 35 33.
1.6	Waste Management and Disposal	.1	Remove from site and dispose of packaging materials at appropriate recycling facilities.
		.2	Collect and separate materials for disposal or recycling in accordance with the Waste Management Plan.

- .3 Place materials defined as hazardous or toxic in designated containers.
 - .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
 - .5 Divert unused concrete materials from landfill as approved by Departmental Representative.
 - .6 Unused paint or coating material must be disposed of at official hazardous material collections site as approved by Departmental Representative.
 - .7 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
 - .8 Fold up metal banding, flatten and place in designated area for recycling.
- 1.7 Storage and Protection
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- .1 Prevent damage to fencing, natural features, water courses, bench marks, lighting systems, roadways and all other equipment encountered during the completion of the work.
 - .2 Repair any damages to original condition.

PART 2 - PRODUCTS

- 2.1 Chain Link Fence Products
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- .1 Materials:
 - .1 Concrete mixes and materials: in accordance with CAN/CSA-A23.1.
 - .1 Nominal coarse aggregate size: 20-5
 - .2 Compressive strength: 20 MPa minimum at 28 days.
 - .3 Additives: fly ash to CAN/CSA-A23.5
 - .2 Chain link fence fabric: to CAN/CGSB-138.1.
 - .1 Black vinyl coated No. 9 gauge steel wire woven in 50 mm mesh, with knuckled finish top and bottom selvage edges.

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- .2 Height of fabric: as indicated.
 - .3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe with black powder coating. Dimensions as indicated.
 - .4 Bottom rail to CAN/CGSB-138.2, galvanized steel bottom rail with black powder coating.
 - .5 Tie wire fasteners: to CAN/CGSB-138.1, Table 2 (steel wire), single strand, galvanized steel wire conforming to requirements of fence fabric, 5 mm diameter.
 - .6 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.
 - .7 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminium.
 - .8 Gates: to CAN/CGSB-138.4.
 - .9 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 41mm outside diameter pipe for outside frame, 27mm outside diameter pipe for interior bracing.
 - .1 Fabricate gates as indicated with electrically welded joints, and paint with zinc pigmented paint 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 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.
 - .10 Fittings and hardware: to CAN/CGSB-138.2, galvanized steel.
 - .1 Tension bar bands: 5 x 16 mm minimum galvanized steel or 5 x 20 mm minimum aluminium.
 - .2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.
 - .3 Turnbuckles to be drop forged.
 - .11 Organic zinc rich coating: to CAN/CGSB-1.181.
 - .12 Finish coating: Epoxy Polyester coating conforming to AAMA

2603 with gloss finish for chain link fencing and associated components. Colour: black. Provide manufacturer's recommended primer. Provide sample for the Department Representative's approval prior to installation.

.2 Galvanized Finishes:

- .1 For chain link fabric: to CAN/CGSB-138.1., Grade 2.
- .2 For pipe: to CAN/CGSB-138.2.
- .3 For other fittings: to CAN/CSA-G164.

.3 Powder Coat Finish:

- .1 Shop apply electrostatic coating in strict accordance with manufacturer's printed instructions.
- .2 Provide primer where required and one finish coat.
- .3 Ensure application of each coat into corners, pinholes and other difficult areas and ensure full coverage to all surfaces.
- .4 Ensure a smooth finish, free of laps, sags, runs, pin holes, crawls and skips. Back lap all edges to achieve full coverage.

PART 3 - EXECUTION

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| <p>3.1 Temporary Erosion and Sediment Control</p> <hr/> | <p>.1
.2
.3</p> | <p>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.</p> <p>Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established</p> <p>Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.</p> |
| <p>3.2 Order of Replacement</p> <hr/> | <p>.1</p> | <p>Complete all work as shown in the plans and specifications.</p> |
| <p>3.3 Existing Fence Removal</p> <hr/> | <p>.1</p> | <p>Existing fencing to be removed and disposed of as directed in an approved landfill location. Concrete foundations to be removed.</p> |
| <p>3.4 Fence Installation</p> <hr/> | <p>.1
.2</p> | <p>Grading:</p> <p>.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.</p> <p>.2 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.</p> <p>Erection of Chain Link Fence:</p> <p>.1 Erect fence along lines as indicated by the contract drawings, the Departmental Representative and to CAN/CGSB-138.3.</p> <p>.2 Excavate post holes as shown on contract drawings and as directed by the Departmental Representative.</p> <p>.3 Space line posts 3m apart, measured parallel to ground surface.</p> <p>.4 Space straining posts at equal intervals not to exceed 150m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than</p> |

150m.

- .5 Install additional straining posts at sharp changes in grade and where directed by the Departmental Representative.
- .6 Install corner post where change in alignment exceeds 10 degrees.
- .7 Install end posts at end of fence and at buildings.
- .8 Place concrete in post holes then embed posts into concrete to depths indicated.
 - .1 Extend concrete 50mm above ground level and slope to drain away from posts.
 - .2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .9 Do not install wire mesh or fence fabric until concrete has cured minimum of 5 days.
- .10 Install brace between end posts and nearest line post, placed in centre of panel and parallel to ground surface.
 - .1 Install braces on both sides of corner and straining posts in similar manner.
- .11 Install top rail between posts and fasten securely to posts and secure waterproof caps.
- .12 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300mm intervals.
 - .1 Knuckled selvedge at bottom.
 - .2 Twisted selvedge at top.
- .13 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450mm intervals.
 - .1 Give tie wires minimum two twists.
- .14 Repair deficient sections of fence as indicated to meet specifications.

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- 3.5 Gate Installation
- .1 Install gates in locations as indicated.
 - .2 Level ground between gate posts and set gate bottom approximately 40mm above ground surface.
 - .3 Install gate stops where required.
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- 3.6 Touch-Up
- .1 Clean all damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas of chain link fence.
 - .1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.
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- 3.7 Cleaning
- .1 Clean and trim areas disturbed by operations.
 - .1 Dispose of surplus material and replace damaged turf with sod and restore areas adjacent to the new fence with native top soil and hydraulic seeding as directed by the Departmental Representative.
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END OF SECTION

PART 1 - GENERAL

1.1	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 74 21 – Construction/Demolition Waste Management And Disposal.
		.3	Section 01 78 00 – Closeout Submittals
		.4	Section 03 30 00 – Cast-in-Place Concrete
		.5	Section 31 00 99 – Earthworks for Minor Works
1.2	Measurement Procedures	.1	Measure packaged sewage lift stations in number of lift stations supplied and installed including stripping, excavating, bedding, backfilling, testing and commissioning.
1.3	References	.1	American National Standards Institute (ANSI)/American Water Works Association (AWWA):
		.1	ANSI/AWWA C500-09, Metal-Seated Gate Valves for Water Supply Service.
		.2	ANSI/AWWA C504-10, Rubber-Seated Butterfly Valves.
		.3	AWWA C507-15 Ball Valves, 6 In. Through 60 In. (150 mm Through 1,500 mm).
		.4	AWWA C508-09, Swing-Check Valves For Waterworks Service 2-In Through 24-In (50-Mm Through 600-Mm) Nps.
		.5	AWWA C517-09 Resilient-Seated Cast-Iron Eccentric Plug Valves
		.6	ANSI/AWWA C900-15, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
		.2	American Society for Testing and Materials International, (ASTM):
		.1	ASTM C 478M-15, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
		.2	ASTM D1784, Standard for Rigid PVC Compounds.
		.3	ASTM D1785, Standard for (Schedule Type) PVC Plastic Pipe.
		.3	Canadian Standards Association (CSA International):
		.1	CAN/CSA-A257.2-14, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
		.2	CSA-B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining.
		.3	CSA-B137.0, Standard for Thermoplastic Piping.
		.4	CSA-B137.3, Standard for Rigid PVC Pipe for Pressure Applications.
		.4	British Columbia Ministry of Health – British Columbia Onsite

		<p>Sewage Association:</p> <ul style="list-style-type: none"> .1 Sewerage System Standard Practice Manual – Version 2, 21 September, 2007.
	.5	<p>City of Penticton Bylaw 2004-81</p> <ul style="list-style-type: none"> .1 Section 00200 – Sanitary Sewers <ul style="list-style-type: none"> .1 13.0 Sanitary Lift Stations .2 14.0 Force Main
1.4 System Description	.1	<p>Reinforced structural plastic or composite enclosure. Pumping system to be factory assembled and disassembled for shipment with mating components clearly identified. Principal items of equipment to include 2 identical submersible sewage pumping units, all internal piping and valves, liquid level controls, lifting chains, guide bars, fall through grate, vents complete with screens, cover, electrical wiring, control panel with circuit breakers and motor starters.</p>
	.2	<p>Equipment and installation to include following:</p> <ul style="list-style-type: none"> .1 Excavation for sewage lift station. .2 Preparation of subgrade. .3 Connection of power to control panel as indicated. .4 Connections to sanitary sewers and force mains. .5 Supply and installation of packaged sewage lift station in accordance with manufacturer's instructions.
	.3	<p>Wet well sewage lift station.</p> <ul style="list-style-type: none"> .1 Fully automatic, consisting of duplex submersible pumps mounted on rail system. Control to be by ultrasonic transducer. .2 Pumps to alternate as lead pump on each cycle. .3 Incorporate time delay in control programming to allow continuation of pump for pre-set time after normal pump shut down signal is received. .4 Operate both pumps when lag pump "on" water level is reached in wet well. Lag pump to shut off when water level drops to pump "off" water level. .5 Locate control system in adjacent control station kiosk.
1.5 Odour Control	.1	<p>Maximum odour to be 1.0 odour unit at 10 m from lift station (during summer conditions, winds between 2 – 10 km/hr)</p>
1.6 Shop Drawings	.1	<p>Submit shop drawings in accordance with Section 01 33</p>

			00 - Submittal Procedures.
		.2	Submit shop drawings for civil, structural, hydraulic, mechanical and electrical elements.
		.3	Indicate individual components by manufacturer's model number and accompany with technical and performance characteristics.
1.7	Closeout Submittals	.1	Provide operation and maintenance data for sewage lift station for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
		.2	Include in this information.
		.1	Record drawings, wiring diagrams, electrical schematics of equipment as installed.
		.2	Interconnections with numbers and wire sizes.
		.3	Certified pump characteristic curves.
		.4	Detailed operation and maintenance instructions.
		.5	Spare parts list comprising a complete schedule clearly identified to facilitate re-ordering.
1.8	Waste Management and Disposal	.1	Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
		.2	Remove from site and dispose of packaging materials at appropriate recycling facilities.
 PART 2 - PRODUCTS			
2.1	Wet Well Structure	.1	Structure : leak free, polyethylene or fibre reinforced plastic with access opening and designed for following forces:
		.1	Dead load of station and components, dynamic and kinetic forces of rotating equipment.
		.2	Hydrostatic Pressure of 3 kPa.
		.3	Saturated soil pressure of 5.75 kPa.
		.4	Dead load from soil over structure, superimposed live load of 12 kN/m ² or single wheel load of 54 kN over an area of 750 x 750 mm.
		.5	Hydrostatic uplift forces.
		.6	Horizontal earth loading and full hydrostatic pressure assuming water at ground elevation.
		.2	Waterproof exterior surfaces below grade.

- 2.2 Wet Well Access
 - .1 Aluminium Hatch Cover
 - .1 Minimum 900 mm x 900 mm opening.
 - .2 Rated for AASHTO-H20 wheel loading.
 - .3 Aluminium ¼" tread plate.
 - .4 Gas assisted spring cylinder.
 - .5 Perimeter sealing gasket.
 - .5 Welded perimeter drain.
 - .6 Recessed, flush lifting handle and flush fitting padlock tang.
 - .7 Hold open arm, locks lid at 90 degrees.
 - .8 Slam lock with sealing plug and opener.
 - .9 Continuous flange anchor.
 - .2 All fasteners, anchors, latches, arms, etc. to be 316 Stainless Steel.
 - .3 Integral Safety Grate Fall Protection System
 - .1 Allow for visual inspection and limited maintenance while the safety grate in place.
 - .2 Grate of 6061-T6 aluminium.
 - .3 Rated for AASHTO-H20 wheel loading.
 - .4 Heavy duty pneumatic springs, 316 Stainless Steel
 - .3 Provide full hatch opening coverage.
 - .4 Permanent hinging system.
 - .5 Lock open in 90 degree position.
 - .6 Internal locking device.
 - .7 Design to ensure fall through protection in place before the doors can be closed.
 - .8 Painted to OSHA safety orange.
 - .1 Base coat: thermosetting epoxy powder coat finish.
 - .2 Top coat: mar-resistant, TIC polyester powder coating.
 - .4 Aluminium Access Ladder
 - .1 Located as to not interfere with pump removal.
 - .2 Extendable and lockable to 600 mm above entrance
- 2.3 Pumps
 - .1 Two vertical, bottom suction, non-clog, heavy duty, totally submersible centrifugal pumps for pumping waste water and sludge, direct connected to motor by solid stainless steel shaft.
 - .2 Minimum Standard
 - .1 Flygt 3000 Series
 - .3 Characteristics:
 - .1 Capacity: 6.85 L/s at 69.61 kPa head.
 - .2 Total dynamic head: 7.1 m

- .3 Maximum static suction lift: 9.4 m.
- .4 Maximum speed: 1750 r/m
- .5 2/2.4 HP

- .3 Pump housing: cast iron, minimum grade Class 30, close coupled.
- .4 Impeller: Polyamide. All fasteners to be stainless steel.
- .5 Capable of passing 75 mm solid sphere.

- 2.4 Pump Lifting System Material
 - .1 Pumps to be complete with sliding guide and brackets, chains and quick leak-proof disconnect to discharge piping, all allowing for withdrawal of pumps.
 - .2 Provide stainless steel cable for each pump accessible from roof access hatches.
 - .3 Stainless steel pipe to act as quick rails for pump.

- 2.5 Submersible Motors
 - .1 Motors.
 - .1 Single phase.
 - .2 Capable of operating pump at any point on selected impeller curve without exceeding motor nominal rating.
 - .3 Fully overload protected.
 - .4 Assembly capable of operating continuously in air without overheating.
 - .2 Motor speed: maximum 1800 r/min.
 - .3 Motor enclosure and seal housing: corrosion resistant, completely watertight, cast iron.
 - .4 Shaft seals: double mechanical seals with tungsten/carbide faces.
 - .5 Motor leads and power cords to be sealed and locked in place using strain bushings. All cables to be waterproof.
 - .6 Check valves: integral, lift-out, swing-clapper with rubber facing.
 - .1 A bronze seat bushing shall be mounted in face of valve to provide a corrosion-proof seat.
 - .2 The clapper shall be mounted on a stainless steel shaft and shall be spring loaded to prevent slamming when closing.
 - .3 The open face of the valve shall be tapered and have a holding groove machined in the face to hold a sealing o-ring.
 - .4 The tapered seat shall allow pump to be nearly sealed at discharge elbow before sealing faces make contact.
 - .5 A guide plate and adjustable guide bar shall fasten to the top of the pump to ensure proper alignment and support of the

					<p>pump.</p> <p>.6 Check valve to lift out with pump to allow for inspection, cleaning, or maintenance of the valve outside the wet well.</p> <p>.7 No additional check valve shall be required in the discharging piping.</p>
2.6	Pump Control System	.1	.1	.1	<p>Liquid level switches: ultrasonic transducer.</p> <p>Minimum Standard</p> <p> .1 Milltronics, XPS-15 Series</p> <p>Provide following independently adjustable control levels as parameters in control program:</p> <p> .1 Lead pump start level.</p> <p> .2 Lag pump start level.</p> <p> .3 Pump stop level</p> <p> .4 High water alarm</p> <p>Lead pump and lag pump to alternate each pumping cycle</p> <p>System to operate during power outage as follows:</p> <p> .1 Loss of utility power shall initiate automatic start of generator.</p> <p> .2 An alarm event shall be generated signalling loss of power.</p> <p> .3 System behaviour is otherwise unchanged, and operations will proceed as described above.</p> <p> .4 Upon return of utility power, after manufacturer’s specified cooling interval, the generator shall shut down automatically.</p> <p>System to operate during pump fault condition as follows:</p> <p> .1 If either pump fails the system will continue operating as described under NORMAL OPERATION with the exception that the sole operating pump will remain as lead. An alarm condition will be indicated.</p> <p>When one-pump operation selected, system to:</p> <p> .1 When the mode control is set to either "P1" or "P2" the system will continue operating as described under NORMAL OPERATION with the exception that selected pump will remain as lead</p>
2.7	Electrical and Control Panel Wiring	.1	.1	.1	<p>In accordance with Section 26 05 00 – Common Work Electrical and Section 26 29 03 – Control Devices.</p>

2.8	Resetting Alarm Conditions	.1	Alarm conditions are to be reset through the use of the reset button on the panel, or may be reset by the control system when the underlying condition is removed.
		.2	The reset button on the panel will serve as an intrusion alarm override.
2.9	Piping, Fittings, and Valves	.1	Pipe, tees, elbows, reducers, sleeve, and related fittings shall be one of the following:
		.1	Cast Iron – to CSA-B70, minimum size 100 mm
		.2	Steel – black seamless, to ASTM Type A53 Grade B with either integral flanges or bevelled end suitable for slip flanges.
		.3	PVC – shall be to AWWA C900, Pipe and fittings to be Schedule 80 unless otherwise specified on the Contract Drawings. PVC joints shall be solvent welded type or threaded type where shown on Contract Drawings.
		.3	Gate valves: solid wedge, Class 125, flanged, to ANSI/AWWA C500.
2.10	Package System	.1	Polyethylene, plastic or composite enclosure complete with all components specified herein.
2.11	Factory Testing	.1	Pumps to have undergone operational tests at the factory to check for excessive vibration, for leaks in piping or seals and for correct operation of automatic control system and auxiliary equipment. Pump suction and discharge lines to have been coupled to reservoir and pumps to recirculate water for minimum of [1] hour under simulated service conditions
		.2	Provide certification that pumps and controls have been factory tested and all deficiencies rectified prior to delivery to site.
PART 3 - EXECUTION			
3.1	Excavation, Backfilling and Compaction	.1	Excavate, backfill and compact in accordance with Section 31 00 99 – Earthworks for Minor Works and as indicated.
3.2	Concrete	.1	Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

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|-------|---------------------------|----|---|
| 3.3 | Equipment
Installation | .1 | Install equipment, piping and controls in accordance with manufacturers' recommendations. |
| | | .2 | Factory trained technician to oversee installation and field testing of equipment. |
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| 3.4 | Waterproofing | .1 | Waterproof in accordance with manufacturers' recommendations. |
| <hr/> | | | |
| 3.5 | Field Quality
Control | .1 | After completion of installation, demonstrate functional operation of systems, including sequence of operation, to approval of Departmental Representative. |
| | | .2 | Test in presence of Departmental Representative and representative from equipment supplier. |
| | | .3 | Provide labour and ancillary equipment necessary to fulfill tests. |
| | | .4 | Test to demonstrate that. <ul style="list-style-type: none"> .1 Pumps and equipment run free from heating, or vibration .2 Operation meets requirements of these specifications .3 Pumps and pumping are free and clear of debris and obstructions. |
| | | .5 | Replace equipment found defective. Repeat test until equipment is accepted by Departmental Representative. |
| <hr/> | | | |
| 3.6 | Demonstration | .1 | Operating Personnel Training: <ul style="list-style-type: none"> .1 Provide onsite training by qualified personnel for designated operating personnel prior to final commissioning. Training to be in accordance with training plan approved by Departmental Representative. .2 Provide training for 3 designated personnel on all routine maintenance procedures, minor repairs, replacement of parts, including disassembly of major components .3 Provide safety precaution procedures for all systems. |

END OF SECTION

PART 1 - GENERAL

1.1	Section Includes	.1	Removable bollards and ground sleeves.
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1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
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1.3	References	.1	Codes and standards referenced in this section refer to the latest edition thereof.
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		.2	American Society for Testing and Materials (ASTM)
		.1	ASTM A513 Type 1 – bollard post
		.2	ASTM A513 Type 5 – bollard ground sleeve
1.4	Performance Requirements	.1	Bollard will remove completely from the ground sleeve and provide flush surface
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		.2	Replace bollard with galvanized filler piece.
		.3	Follow manufacturer’s specifications and installation instructions as required.
1.5	Submittals	.1	Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
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1.6	Quality Control	.1	Bollard and ground sleeves must be factory supplied to provide consistent quality in appearance and performance.
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1.7	Delivery, Storage and Handling	.1	Inspect materials upon receipt to ensure that the correct materials have been received and that they are in good condition.
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		.2	If not installing immediately, store units to avoid damage from other construction activities and the elements.

PART 2 - PRODUCTS

- 2.1 Materials
 - .1 Bollards supplied should be free from surface blemishes and defects where exposed to view in the finished installation.
 - .2 Steel Tube: ASTM A513 Type 1, ASTM A513, Type 5
 - .3 Minimum Standard
 - .1 TrafficGaurd RPT Series
- 2.2 Finishes
 - .1 All surfaces to be primed with rust & corrosion resistant, zinc rich primer w/ 5,000 hour salt spray performance.
 - .2 Standard finish, TGIC Polyester outdoor finish RAL1028 Yellow. TGIC Polyester powder definition; meets decorative and functional requirements for gloss retention, physical properties, chemical resistance and weatherability.

PART 3 - EXECUTION

- 3.1 Installation
 - .1 Comply with manufacturer provided instructions and drawings.
 - .2 Ground sleeves should be installed with the top of the sleeve set flush with the finished surface.
 - .3 Ensure that a minimum of a 75 mm gravel base is put down prior to installation to ensure drainage of the bollard, per installation details.
 - .4 Bollard should not be inserted into the ground sleeve until it is leveled and fully cured. Attach bollard per manufacturer instructions.
 - .5 If touch up painting in the field, ensure no paint impacts moving parts which may restrict the bollard's proper function.

END OF SECTION

PART 1 - GENERAL

- 1.1 Related Sections
 - .1 Section 01 33 00 - Submittal Procedures.
 - .2 Section 01 74 21 - Construction/ Demolition Waste Management And Disposal.
 - .3 Section 31 00 99 – Earthworks for Minor Works.

- 1.2 Measurement Procedures
 - .1 Measure hydraulic seeding in square metres of actual surface area for:
 - .1 Grass mixture including fertilizer.
 - .2 Measure maintenance during establishment period and warranty period of areas seeded in square metres.

- 1.3 Submittals
 - .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide product data for:
 - .1 Seed.
 - .2 Mulch.
 - .3 Tackifier.
 - .4 Fertilizer.
 - .3 Submit in writing to Departmental Representative 5 days prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in litres.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

- 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 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

- 1.5 Scheduling
 - .1 Schedule hydraulic seeding to coincide with preparation of soil surface.

- 1.6 Waste Management And Disposal
 - .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/ Demolition Waste Management And Disposal.
 - .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
 - .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

- 2.1 Materials
 - .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
 - .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
 - .1 26% Perennial Ryegrass.
 - .2 24% Creeping Red Fescue.
 - .3 14 % Aliske Clover.
 - .4 13% Hard Fescue.
 - .5 9% White Clover
 - .6 8% Timothy

- .7 4% Canada Bluegrass
- .8 2% Redtop
- .2 Mulch: specially manufactured for use in hydraulic seeding equipment, non toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
 - .1 Type I mulch:
 - .1 Made from wood cellulose fibre.
 - .2 Organic matter content: 95% plus or minus 0.5%.
 - .3 Value of pH: 6.0.
 - .4 Potential water absorption: 900%.
 - .3 Tackifier: water soluble vegetable carbohydrate powder.
 - .4 Water: free of impurities that would inhibit germination and growth.
 - .5 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete synthetic, slow release with 16% of nitrogen content in water insoluble form – 16-32-6.

PART 3 - EXECUTION

3.1 Workmanship

- .1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.
- .2 Clean up immediately, any material sprayed where not intended, to satisfaction of the Departmental Representative.
- .3 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .4 Protect seeded areas from trespass until plants are established.

3.2 Preparation Of Surfaces

- .1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.
- .2 Cultivated areas identified as requiring cultivation to depth of 25 mm.

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- .3 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
 - .4 Obtain Departmental Representative approval of grade and topsoil depth before starting to seed.
 - 3.3 Fertilizing Program

 - .1 Fertilize prior to fine grading incorporating fertilizer equally distributed in accordance with manufacturers recommendations.
 - .2 Fertilize twice during establishment and warranty periods.
 - 3.4 Preparation Of Slurry

 - .1 Measure quantities of materials by weight or weight calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
 - .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
 - .3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.
 - 3.5 Slurry Application

 - .1 Hydraulic seeding equipment:
 - .1 Slurry tank.
 - .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/ or mechanical agitation method.
 - .3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
 - .2 Slurry mixture applied per hectare to be per manufacturers recommendations.
 - .3 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
 - .1 Using correct nozzle for application.
 - .2 Using hoses for surfaces difficult to reach and to control application.

- .4 Blend application 300 mm into adjacent grass areas or sodded areas and previous applications to form uniform surfaces.
 - .5 Re apply where application is not uniform.
 - .6 Remove slurry from items and areas not designated to be sprayed.
 - .7 Protect seeded areas from trespass satisfactory to the Departmental Representative.
 - .8 Remove protection devices as directed by the Departmental Representative.
- 3.6 Maintenance During Establishment Period
-
- .1 Perform following operations from time of seed application for a minimum of two months or until acceptance by Departmental Representative .
 - .2 Grass Mixture:
 - .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
 - .2 Mow grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass.
 - .3 Fertilize seeded areas after first in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles ;water in well.
 - .4 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
 - .5 Water seeded areas to maintain optimum soil moisture level for germination and continued growth. Control watering to prevent washouts.
- 3.7 Acceptance
-
- .1 Seeded areas will be accepted by Departmental Representative provided that:
 - .1 Plants are uniformly established. Seeded areas are free of rutted, eroded, bare or dead spots.
 - .2 Areas have been mown at least twice.
 - .3 Areas have been fertilized.
 - .2 Areas seeded in fall will achieve final acceptance in following spring,

-
- one month after start of growing season provided acceptance conditions are fulfilled.
- 3.8 Maintenance During Warranty Period
- .1 Perform following operations from time of acceptance until end of the one year warranty period:
- .1 Repair and reseed dead or bare spots to satisfaction of the Departmental Representative.
 - .2 Mow areas seeded, remove clippings, as directed by Departmental Representative, a minimum of four times during the warranty period.
 - .3 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
- 3.9 Cleaning
- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 - GENERAL

<u>1.1</u>	Section Includes	.1	Materials and installation for constructing new outfall structures, precast and cast-in-place manholes and catch basins.
<u>1.2</u>	Related Sections	.1	Section 01 11 05 – General Instructions.
		.2	Section 03 30 00 – Cast in place Concrete
		.3	Section 31 00 99 – Earthworks for Minor Works
		.4	Section 33 31 13 – Public Sanitary Utility Sewerage Piping
<u>1.3</u>	References	.1	American Society for Testing and Materials (ASTM International).
		.1	M A48/A48M, Standard Specification for Gray Iron Castings.
		.2	ASTM C139, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
		.3	ASTM C478M, Specification for Precast Reinforced Concrete Manhole Sections Metric
		.2	Canadian General Standards Board (CGSB).
		.1	CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
		.2	CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
		.3	Canadian Standards Association (CSA International).
		.1	CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
		.2	CAN/CSA-G30.18-M92, Billet Steel Bars for Concrete Reinforcement.
		.3	CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
<u>1.4</u>	Submittals	.1	Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.
<u>1.5</u>	Scheduling of	.1	Schedule work to minimize interruptions to existing services and to

Work	maintain existing flow during construction.
.2	Submit schedule of expected interruptions for approval and adhere to approved schedule.

PART 2 - PRODUCTS

2.1 Materials	.1 Cast-in-place concrete: to Section 03 30 00 - Cast-in-Place Concrete.
	.2 Concrete reinforcement: to Section 03 20 00 - Concrete Reinforcement.
	.3 Precast manhole units: to ASTM C478M, circular or oval. Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
	.4 Precast catch basin sections: to ASTM C478M.
	.5 Joints: to be made watertight using rubber rings.
	.6 Mortar:
	.1 Aggregate: to CSA A82.56.
	.2 Cement: to CAN/CSA-A8.
	.7 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164. Rungs to be safety pattern (drop step type).
	.8 Adjusting rings: to ASTM C478M.
	.9 Concrete Brick: to CAN3-A165 Series.
	.10 Drop manhole pipe: to be same as sewer pipe.
	.11 Steel gratings, I-beams and fasteners: as indicated.
	.12 Frames, gratings, covers to dimensions as indicated and following requirements:
	.1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
	.2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
	.3 Castings: coated with two applications of asphalt varnish or

cleaned and ground to eliminate surface imperfections.

- .4 Manhole frames and covers: heavy duty municipal type for road service; Cover cast without perforations and complete with two 25 mm square lifting holes.
- .13 Granular bedding and backfill meeting the following requirements:
 - .1 Crushed screed stone, gravel or sand.
 - .2 Granulations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.1.

.3 TABLE

Sieve Designation	% Passing Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30-90
0.425 mm	10-25	10-50
0.180 mm	-	-
0.075 mm	0-8	0-10

- .4 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

PART 3 - EXECUTION

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|-----------------------------|----|--|
| 3.1 Excavation and Backfill | .1 | Excavate and backfill in accordance with Section 31 00 99 – Earthworks for Minor Works and as indicated. |
| | .2 | Obtain approval of Owner’s Representative before installing, manholes or catch basins. |
| 3.2 Concrete Working | .1 | Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete. |
| | .2 | Position metal inserts in accordance with dimensions and details as |

-
- indicated.
- 3.3 Installation
- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
 - .2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.
 - .3 Dewater excavation to approval of Owner's Representative and remove soft and foreign material before placing concrete base.
 - .4 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% corrected maximum dry density.
 - .5 Precast units:
 - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with Owner's Representative approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination thereof.
 - .2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
 - .3 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
 - .6 Compact granular backfill to 95% corrected maximum dry density.
 - .7 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfill.
 - .8 Set frame and cover to required elevation on no more than 4 courses of brick. Make brick joints and join brick to frame with cement mortar. Parge and make smooth and watertight.
 - .9 Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.
 - .10 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.
 - .11 Install safety platforms in manholes having depth of 5 m or greater, as indicated.

3.4 Leakage Test

- .1 Install watertight plugs or seals on inlets and outlets of each new manhole and fill manhole with water. Leakage not to exceed 0.3% per hour of volume of manhole.
- .2 If permissible leakage is exceeded, correct defects. Repeat until approved by Owner's Representative.
- .3 Owner's Representative will issue Test Certificate for each manhole passing test.
- .4 Provide copy certification of leakage test acceptance to Owner's Representative. Include certification in Commissioning Manual.

END OF SECTION

PART 1 - GENERAL

1.1	Section Includes	.1	Materials and installation for water mains, hydrants, valves, valve boxes, and valve chambers, including service connections.
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1.2	Related Sections	.1	Section 01 11 05 – General Instructions.
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		.2	Section 02 82 00.02 – Asbestos Abatement
		.3	Section 03 30 00 – Cast in place Concrete
		.4	Section 31 00 99 – Earthworks for Minor Works
		.5	City of Penticton Bylaw 2004-81
1.3	Measurement Procedures	.1	Measure water main including trenching, bedding, surround (concrete or other) and backfilling, in metres of each size of pipe installed.
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		.1	Horizontal measurement will be made over surface, through valves and fittings, after work has been completed.
		.2	Measure lateral connections from water main to hydrants as water main and include curb valve and adjustable valve box.
		.2	Measure hydrants including excavation and backfilling, in units installed.
		.3	Measure service connections including trenching and backfilling, in metres of each size of pipe.
		.4	Measure valves in units installed including excavation and backfilling, valves and valve boxes and thrust blocks.
		.5	Measure valve chambers including excavation and backfilling, in units installed.
1.4	References	.1	American National Standards Institute/American Water Works Association (ANSI/AWWA):
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		.1	ANSI/AWWA B300-10, Hypochlorites.
		.2	ANSI/AWWA C500-02, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).

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- .3 ANSI/AWWA C504-10, Rubber-Seated Butterfly Valves.
 - .4 ANSI/AWWA C651-14, Disinfecting Water Mains.
 - .5 ANSI/AWWA C800-12, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
 - .6 ANSI/AWWA C900-15, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
- .2 American Society for Testing and Materials International, (ASTM):
- .1 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .2 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube Metric.
 - .3 ASTM C117-13, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136-14, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C478M-15, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .6 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - .7 ASTM D2310-01, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
 - .8 ASTM D2657-07, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
 - .9 ASTM D2992-12, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.
 - .10 ASTM D2996-01(2007)e1, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

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- .11 ASTM F714-13, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - .12 ASTM C618-12a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .3 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
 - .4 CGSB 41-GP-25M-[], Pipe, Polyethylene, for the Transport of Liquids.
 - .4 Canadian Standards Association (CSA International):
 - .1 CAN/CSA-A257.2-14, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
 - .2 CAN/CSA-A3000-13, Cementitious Materials Compendium
 - .1 CAN/CSA-A8-98, Masonry Cement.
 - .3 CSA B137 Series-02, Thermoplastic Pressure Piping Compendium.
 - .1 CSA B137.1-02, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 - .2 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
 - .4 CAN/CSA-G30.18-09 (R2014), Billet Steel Bars for Concrete Reinforcement
 - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles
 - .5 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
 - .6 Transport Canada (TC):
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

- .7 The Master Painters Institute (MPI):
 - .1 Architectural Painting Specification Manual - March 1998(R2002).
 - .8 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S520-07, Fire Hydrants.
 - .2 CAN4-S543-09, Standard for Internal Lug Quick-Connect Couplings for Fire Hose.
 - .9 National Fire Protection Association (NFPA):
 - .1 NFPA-291-Recommended Practice for Fire Flow Testing and Marking of Hydrants.
- 1.5 Submittals
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- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform the Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.
 - .3 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
 - .4 Pipe certification to be on pipe.
- 1.6 Close-out Submittals
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- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 11 05 – General Instructions.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.
 - .2 Include location, in plan only, of all water system components on airport property.
- 1.7 Waste Management and
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- .1 Separate waste materials for reuse and recycling in accordance with

<u>Disposal</u>	Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
	.2 Remove from site and dispose of packaging materials at appropriate recycling facilities:
	.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
	.4 Separate for reuse and recycling and place in designated containers 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 Ensure emptied containers are sealed and stored safely.
	.8 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by the Departmental Representative.
	.9 Divert unused concrete materials from landfill to local facilities as approved by the Departmental Representative.
	.10 Dispose of unused asbestos cement pipe in accordance with regulations governing disposal of hazardous materials.
	.11 Divert unused aggregate materials from landfill to appropriate facilities for reuse as approved by the Departmental Representative.
	.12 Dispose of unused disinfection material at official hazardous material collections site approved by the Departmental Representative.
	.13 Do not dispose of unused disinfection material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.
	.14 Fold up metal banding, flatten and place in designated area for recycling.
1.8 <u>Scheduling of Work</u>	.1 Schedule Work to minimize interruptions to existing services.

- .2 Submit schedule of expected interruptions to the Departmental Representative for approval and adhere to interruption schedule as approved by the Departmental Representative.
- .3 Notify the Departmental Representative minimum of 24 h in advance of interruption in service.
- .4 Do not interrupt water service for more than 2 h and confine this period between 07:00 and 15:30 h local time unless otherwise authorized.
- .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .6 Provide "Out of Service" sign on hydrant not in use.
- .7 Advise local police department of anticipated interference with movement of traffic.

PART 2 - PRODUCTS

<p>2.1 Pipe, Joints and Fittings</p>	<ul style="list-style-type: none"> .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end. <ul style="list-style-type: none"> .1 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket and/or coupling. .2 Cast iron fittings: to ANSI/AWWA C110/A21.10, and for pipe diameters larger than NPS4 cement mortar lined to ANSI/AWWA C104/A21.4. .2 To City of Penticton Bylaw 2004-81, Section 2666, or approved by addendum during tender.
<p>2.2 Valves and Valve Boxes</p>	<ul style="list-style-type: none"> .1 As shown on Contract Drawings. .2 To City of Penticton Bylaw 2004-81, Section 2666, or approved by addendum during tender.
<p>2.3 Service Connections</p>	<ul style="list-style-type: none"> .1 As shown on Contract Drawings. .2 To City of Penticton Bylaw 2004-81, Section 2666, or approved by addendum during tender.
<p>2.4 Pipe Bedding and Surround</p>	<ul style="list-style-type: none"> .1 As shown on Contract Drawings ann accordance with Section 31 00

		99 – Earthwork for Minor Works.
	.2	Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.
2.5 Hydrants	.1	As shown on Contract Drawings.
	.2	To City of Penticton Bylaw 2004-81, Section 2666, or approved by addendum during tender.
2.6 Heat Shrink Wrap	.1	Heat shrink joint wrap to be applied to all pipe joints within 3m of horizontal separation of sanitary or storm sewer piping.
	.1	Minimum Standard
	.1	CANUSA Aquashield AQW-HS
	.2	Installed in accordance with manufacturer’s recommended installation instructions and AWWA C216-07.
2.7 Backfill Material	.1	As shown on Contract Drawings and in accordance with Section 31 00 99 – Earthwork for Minor Works.
2.8 Pipe Disinfection	.1	Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.
	.2	Undertake disinfection of water mains in accordance with ANSI/AWWA C651 and City of Penticton requirements.
 PART 3 - EXECUTION		
3.1 Preparation	.1	Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
	.1	Inspect materials for defects to approval of the Departmental Representative.
	.2	Remove defective materials from site as directed by the Departmental Representative.
3.2 Trenching	.1	Do trenching work in accordance with Section 31 00 99 – Earthwork for Minor Works.

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|-------------------------------------|----|--|
| | .2 | Trench depth to provide cover over pipe as indicated. |
| | .3 | Trench alignment and depth require the Departmental Representative's approval prior to placing bedding material and pipe. |
| 3.3 Concrete Bedding and Encasement | .1 | Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete. |
| | .1 | Place concrete to details as indicated. |
| | .2 | Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed. |
| | .3 | Do not backfill over concrete within 24 hours after placing. |
| 3.4 Granular Bedding | .1 | Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated. |
| | .2 | Do not place material in frozen condition. |
| | .3 | Shape bed true to grade to provide continuous uniform bearing surface for pipe. |
| | .4 | Shape transverse depressions in bedding as required to suit joints. |
| | .5 | Compact each layer full width of bed to at least 95% of corrected maximum dry density. |
| | .6 | Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 00 99 – Earthwork for Minor Works. |
| 3.5 Pipe Installation | .1 | Lay pipes to ANSI/AWWA C600 and manufacturer's standard instructions and specifications. Do not use blocks except as specified. |
| | .2 | Join pipes in accordance with ANSI/AWWA C600 and manufacturer's recommendations. |
| | .3 | Bevel or taper ends of PVC pipe to match fittings. |
| | .4 | Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends. |

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- .5 Lay pipes on prepared bed, true to line and grade:
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
 - .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
 - .7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
 - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials:
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .9 Position and join pipes with equipment and methods approved by the Departmental Representative.
 - .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .11 Align pipes before jointing.
 - .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
 - .14 Complete each joint before laying next length of pipe.
 - .15 Minimize deflection after joint has been made.

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- .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
 - .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Departmental Representative.
 - .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
 - .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
 - .20 Do not lay pipe on frozen bedding.
 - .21 Do hydrostatic and leakage test and have results approved by the Departmental Representative before surrounding and covering joints and fittings with granular material.
 - .22 Backfill remainder of trench.
- 3.6 Valve Installation
- .1 Install valves to manufacturer's recommendations at locations as indicated.
 - .2 Support valves located in valve boxes or valve chambers by means of bedding same as adjacent pipe. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.
 - .3 Install underground post-type indicator valves as indicated.
- 3.7 Service Connections
- .1 Terminate building water service 1 m outside building wall opposite point of connection to main.
 - .1 Install coupling necessary for connection to building plumbing.
 - .2 If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
 - .2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.
 - .3 Tappings on ductile iron, or PVC-C900 pipe, may be threaded without service clamps:
 - .1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be

used.

.2 Tappings for PVC-C900 pipe to conform to following:

Pipe Diameter (mm)	Maximum Tap without Clamp (mm)	Maximum Tap with Clamp (mm)
100	20	25
150	20	40
200	25	50
250	25	50
300	40	75

.4 Maximum direct tapings (mm) for ductile iron pipe to conform to:

Nominal Pipe Size (mm)	Pressure Class / Max				
	100	200	250	300	350
75					19
102					19
152					25
203					25
254					25
305					32
356			32	38	38
406			38	50	50
457			50	50	50
508			50	50	50
610		50	50	50	50
762	50	50	50	50	50

- .5 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.
- .6 Tappings for PE pipe: PE tapping tees or multi-saddle tees.
- .7 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
- .8 Install multiple corporation stops, 30 degrees apart around circumference of pipe and minimum of 300 mm apart along pipe.
- .9 Leave corporation stop valves fully open.
- .10 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
- .11 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
- .12 Install curb stop with corporation box on services NPS 2 or less in diameter.
 - .1 Equip larger services with gate valve and cast iron box.
 - .2 Set box plumb over stop and adjust top flush with final grade elevation.
 - .3 Leave curb stop valves fully closed.
- .13 Place temporary location marker at ends of plugged or capped unconnected water lines.
 - .1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
 - .2 Paint exposed portion of stake blue with designation "WATER SERVICE LINE" in black.

3.8 Valve Installation

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by the Departmental Representative.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 For restrained joints: only use restrained joints approved by the Departmental Representative.

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- 3.9 Hydrostatic and Leakage Testing
- .1 Do tests in accordance with ANSI/AWWA C600 and/or C603.
 - .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
 - .3 Notify the Departmental Representative at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of the Departmental Representative.
 - .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
 - .5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Departmental Representative.
 - .6 Upon completion of pipe laying and after the Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
 - .7 Leave hydrants, valves, joints and fittings exposed.
 - .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
 - .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
 - .10 Open valves.
 - .11 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
 - .12 Fill asbestos cement pipe and concrete pipe at least 24 hours before testing to allow water absorption by pipe material.
 - .13 Thoroughly examine exposed parts and correct for leakage as necessary
 - .14 Apply hydrostatic test pressure of 1380 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for

period of 1 hour.

- .15 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .16 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .17 Repeat hydrostatic test until defects have been corrected.
- .18 Apply leakage test pressure of 690 kPa after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .19 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
- .20 Do not exceed allowable leakage of 1.079 L/day/km/mm of pipe, including lateral connections.
- .21 Locate and repair defects if leakage is greater than amount specified.
- .22 Repeat test until leakage is within specified allowance for full length of water main.

3.10 Pipe Surround

- .1 Upon completion of pipe laying and after the Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 2 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% of Modified Proctor.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90% of Modified Proctor.

3.11 Backfill

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.

- .2 Do not place backfill in frozen condition.
- .3 Under paving and walks, compact backfill to at least 95 Modified Proctor.
 - .1 In other areas, compact to at least 90% Modified Proctor.

3.12 Flushing and Disinfecting

- .1 Flushing and disinfecting operations: witnessed by the Departmental Representative carried out by specialist contractor.
 - .1 Notify the Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .3 Flushing flows as follows:

Pipe Size (NPS)	Flow (L/s) minimum
6 and below	38
8	75
10	115
12	150

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to the Departmental Representative approval, introduce strong solution of chlorine as approved by the Departmental Representative into water main and ensure that it is distributed throughout entire system.
- .7 Disinfect water mains-Specialist contractor to perform disinfection.
- .8 Rate of chlorine application to be proportional to rate of water

- entering pipe.
- .9 Chlorine application to be close to point of filling water main and to occur at same time.
- .10 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .11 Flush line to remove chlorine solution after 24 hours.
- .12 Measure chlorine residuals at extreme end of pipe-line being tested.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
 - .1 Take samples daily for minimum of two days.
 - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
 - .3 Specialist contractor to submit certified copy of test results.
- .14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .15 After adequate chlorine residual, not less than 50 ppm, has been obtained leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- 3.13 Surface Restoration
 - .1 After installing and backfilling over water mains, restore surface to original condition as directed by the Departmental Representative.
- 3.14 Asbestos Cement Watermain
 - .1 Handling and disposal of identified Asbestos Cement water main shall be in accordance with NRCC-52715 – “Safety and Waste Management of Asbestos Cement Pipes”, Section 02 82 00.02 – Asbestos Abatement, and with all applicable City of Penticton standards and specifications.
- 3.15 Hydrant Flow Testing
 - .1 Flow test hydrants in accordance with chapter 4 of NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants. Submit all required data sheets with close-out submittals.

END OF SECTION

PART 1 - GENERAL

1.1	Section Includes	.1	Materials and installation for gravity sewers.
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1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
		.3	Section 03 30 00 – Cast in Place Concrete
		.4	Section 31 00 99 – Earthworks for Minor Works
1.3	Measurement Procedures	.1	Measure supply and installation of sanitary sewer, including excavating and backfilling, thrust blocks, and granular bedding and surround, in metres of each type and size of pipe installed. Measurement will be made of actual length in place, through valves and fittings, after work has been completed.
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1.4	References	.1	American National Standards Institute/American Water Works Association (ANSI/AWWA):
		.1	ANSI/AWWA C900-2007, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inch-12 Inch (100 mm-300 mm), for Water Distribution.
		.2	American Society for Testing and Materials International, (ASTM):
		.1	ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
		.2	ASTM D2680-01(2009), Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
		.3	ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
		.4	ASTM D3350-12, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
		.3	Canadian General Standards Board (CGSB):
		.1	CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
		.2	CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
		.3	CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.
		.4	Canadian Standards Association (CSA International):
		.1	CSA B1800-11, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2,

B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

- .1 CSA B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.
- .2 CSA B182.2-11, PVC Sewer Pipe and Fittings (PSM Type).
- .3 CSA B182.6-11, Profile Polyethylene Sewer Pipe and Fittings for Leak-Proof Sewer Applications.
- .4 CSA B182.11-11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

.5 Department of Justice Canada (Jus):

- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.6 Transport Canada (TC):

- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.5 Submittals

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide Departmental Representative at least 2 weeks prior to beginning Work, with proposed source of bedding materials and provide access for sampling.
- .3 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Certification to be marked on pipe.
- .5 Submit manufacturers information data sheets and instructions in accordance with Section 01 33 00 - Submittal Procedures.

1.6 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with manufacturers' recommendations.

1.7 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

PART 2 - PRODUCTS

- 2.1 Plastic Pipe
- .1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034 or CSA-B182.2:
 - .1 Standard Dimensional Ratio (SDR): 41.
 - .2 Locked-in gasket and integral bell system.
 - .4 Nominal lengths: 4 m.
 - .2 Acrylonitrile - Butadiene - Styrene (ABS): to ASTM D2680 or CSA-B182.2.
 - .3 Corrugated High Density Polyethylene (HDPE): to ASTM D3350 or CSA-B182.6.
 - .1 180 kPa pipe stiffness.
 - .2 Sewer class
 - .3 Gasket and bell] or Mechanical non-gasket coupling system.

- 2.2 Pipe Bedding and Surround Materials
- .1 Granular material to Section 31 00 99 – Earthworks for Minor Works and following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
 - .2 Gradation Table.

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30- 90
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10

- .3 Concrete mixes and materials for thrust blocks to Section 03 30 00 - Cast-in-Place Concrete.

2.3 Backfill Material .1 As indicated.

PART 3 - EXECUTION

- 3.1 Preparation
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- .1 Pipes and fittings to be clean and dry.
 - .2 Prior to installation, obtain Departmental Representative’s approval of pipes and fittings.
- 3.2 Trenching
-
- .1 Do trenching Work, in accordance with Section 31 00 99 – Earthworks for Minor Works.
 - .2 Do not allow contents of any sewer or sewer connection to flow into trench.
 - .3 Trench alignment and depth require approval from Departmental Representative prior to placing bedding material or pipe.
- 3.3 Granular Bedding
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- .1 Place granular bedding in unfrozen condition.
 - .2 Place granular bedding material in uniform layers not exceeding 200 mm compacted thickness to depth as indicated.
 - .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .4 Shape transverse depressions as required to suit joints.
 - .5 Compact each layer full width of bed to at least 95% Modified Proctor, to ASTM D1557.
 - .6 Fill excavation below design elevation of bottom of specified bedding with common backfill.
- 3.4 Installation
-
- .1 Lay pipes in accordance with manufacturer's recommendations.
 - .2 Join pipes in accordance with manufacturer's recommendations.
 - .3 Avoid damage to machined ends of pipes in handling and moving pipe.
 - .4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
 - .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.
 - .7 Do not allow water to flow through pipe during construction.
 - .8 Whenever Work is suspended, install removable watertight

-
- bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CSA B182.11.
 - .10 Pipe jointing:
 - .1 Install gaskets [in accordance with manufacturer's recommendations
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material
 - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage
 - .8 At rigid structures, install pipe joints not more than [1.2] m from side of structure.
 - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
 - .11 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.
 - .12 Plug lifting holes with pre-fabricated plugs approved Departmental Representative, set in shrinkage compensating grout.
 - .13 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .14 Make watertight connections to manholes or plastic tanks.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available
 - .15 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

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- 3.5 Pipe Surround
- .1 Place surround material in unfrozen condition.
 - .2 Upon completion of pipe laying, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
 - .3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 200 mm compacted thickness as indicated. Do not dump material within 2 m of pipe.
 - .4 Place layers uniformly and simultaneously on each side of pipe
 - .5 Compact each layer from pipe invert to mid height of pipe to at least 95% Modified Proctor, to ASTM D15578.
 - .6 Compact each layer from mid height of pipe to underside of backfill to at least 90% Modified Proctor, to ASTM D1557.
 - .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.
- 3.6 Backfill
- .1 Place backfill material in unfrozen condition.
 - .2 Place backfill material, above pipe surround in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.
- 3.7 Field Testing
- .1 Repair or replace pipe, pipe joint or bedding found defective.
 - .2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 95% of nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
 - .3 Remove foreign material from sewers and related appurtenances by flushing with water.
 - .4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
 - .5 Do infiltration and exfiltration testing as specified herein and as directed by Departmental Representative.
 - .1 Perform tests in presence of Departmental Representative.
 - .2 Notify Departmental Representative 24 hours in advance of proposed tests.
 - .6 Carry out tests on each section of sewer between successive manholes including service connections.
 - .7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
 - .8 Exfiltration test.
 - .1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.

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- .2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.
 - .3 Duration of exfiltration test: 2 hours.
 - .4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes
 - .9 Infiltration test.
 - .1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used
 - .2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
 - .3 Install watertight plug at upstream end of pipeline test section.
 - .4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter
 - .5 Prevent damage to pipe and bedding material due to flotation and erosion.
 - .6 Place 90 degrees V-notch weir, or other measuring device approved by Departmental Representative in invert of sewer at each manhole.
 - .7 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval
 - .10 Leakage: not to exceed following limits in litres per hour per mm of diameter per 100 m of sewer including service connections.
 - .1 Exfiltration, based on 600 mm head: 0.175 L
 - .2 Infiltration: 0.150 L.
 - .11 Repair and retest sewer line as required, until test results are within limits specified.
 - .12 Repair visible leaks regardless of test results.

END OF SECTION

PART 1 - GENERAL

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|-------|------------------------|----|--|
| 1.1 | Section Includes | .1 | Materials and installation for sewage force mains. |
| <hr/> | | | |
| 1.2 | Related Sections | .1 | Section 01 33 00 – Submittal Procedures. |
| | | .2 | Section 01 74 21 – Construction/Demolition Waste Management and Disposal. |
| | | .3 | Section 03 30 00 – Cast in Place Concrete |
| | | .4 | Section 31 00 99 – Earthworks for Minor Works |
| 1.3 | Measurement Procedures | .1 | Measure supply and installation of sewage force main, including excavating and backfilling, thrust blocks, and granular bedding and surround, in metres of each type and size of pipe installed. Measurement will be made of actual length in place, through valves and fittings, after work has been completed. |
| <hr/> | | | |
| 1.4 | References | .1 | American National Standards Institute/American Water Works Association (ANSI/AWWA): |
| | | .1 | ANSI/AWWA C900-2007, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inch-12 Inch (100 mm-300 mm), for Water Distribution. |
| | | .2 | American Society for Testing and Materials International, (ASTM): |
| | | .1 | ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates. |
| | | .2 | ASTM C117-13, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing. |
| | | .3 | ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort. |
| | | .4 | ASTM D2241-09, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series). |
| | | .5 | ASTM D2310-12, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe. |
| | | .6 | ANSI/ASTM D2992-12, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting. |
| | | .7 | ASTM D2996-07, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber- Reinforced Thermosetting Resin Pipe). |
| | | .8 | ASTM D3034-08, Standard Specification for Type PSM |

PART 2 - PRODUCTS

- 2.1 Materials
 - .1 Polyvinyl chloride (PVC) pipe: to CSA-B137.3 or ANSI/AWWA C900:
 - .1 SDR: 18.
 - .2 Pressure Class: 1 MPa.
 - .3 Gasket bell end.
 - .4 Pipe joints: bell and spigot with rubber gaskets solvent welded joints or mechanical joints to ANSI/AWWA C111/A21.11, with transition gaskets to pipe manufacturers specifications
 - .5 Rubber gaskets: to ANSI/AWWA C111/A21.11. Gaskets for mechanical joints to be duck-tipped transition gaskets for PVC.
 - .2 Polyethylene pressure pipes: to CSA-B137.1 or CGSB 41-GP-25M.
 - .1 SDR: 11
 - .2 Joints: to ANSI/AWWA C207, thermal butt fusion or flanged with steel or aluminum backing flanges.
 - .3 Polyethylene fittings: to CSA-B137.1, for pipe sizes 4" and less.
- 2.2 Pipe Bedding and Surround Materials
 - .1 Granular material to Section 31 00 99 – Earthworks for Minor Works and the following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
 - .2 Gradation Table.

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	80-100
2.00 mm	-	50- 90
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10

	.3	Concrete mixes and materials for thrust blocks to Section 03 30 00 - Cast-in-Place Concrete.
2.3 Backfill Material	.1	As indicated.
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PART 3 - EXECUTION		
3.1 Preparation	.1	Pipes and fittings to be clean and dry.
	.2	Prior to installation, obtain Departmental Representative's approval of pipes and fittings.
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3.2 Trenching	.1	Do trenching Work, in accordance with Section 31 00 99 – Earthworks for Minor Works.
	.2	Trench alignment and depth require approval from Departmental Representative prior to placing bedding material or pipe.
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3.3 Granular Bedding	.1	Place granular bedding in unfrozen condition.
	.2	Place granular bedding material in uniform layers not exceeding 200 mm compacted thickness to depth as indicated.
	.3	Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
	.4	Shape transverse depressions as required to suit joints.
	.5	Compact each layer full width of bed to at least 95% Modified Proctor, to ASTM D1557.
	.6	Fill excavation below design elevation of bottom of specified bedding with common backfill.
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3.4 Installation	.1	Lay pipes in accordance with manufacturer's recommendations.
	.2	Join pipes in accordance with manufacturer's recommendations.
	.3	Avoid damage to machined ends of pipes in handling and moving pipe.
	.4	Maintain grade and alignment of pipes.
	.5	Align pipes carefully before jointing.
	.6	Do not exceed maximum joint deflection recommended by pipe manufacturer.
	.7	Support pipe firmly over entire length, except for clearance necessary at couplings. Do not use blocks to support pipe.
	.8	Keep pipe and pipe joints free from foreign material.
	.9	Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Remove disturbed

- .10 gaskets clean, lubricate and replace before jointing is attempted. Support pipes using hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .11 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.
 - .12 Apply restraint to pipe to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by Departmental Representative.
 - .13 When stoppage of Work occurs, block pipe to prevent creep during downtime.

- 3.5 Thrust Blocks
 - .1 Restrain bends, tees and fittings by concrete thrust blocks as indicated.
 - .2 Keep pipe couplings free of concrete.
 - .3 Bearing area of thrust blocks to be as indicated.

- 3.6 Pipe Surround
 - .1 Place surround material in unfrozen condition.
 - .2 Upon completion of pipe laying, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
 - .3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 200 mm compacted thickness as indicated. Do not dump material within 2 m of pipe.
 - .4 Compact each layer from pipe invert to mid height of pipe to at least 95% Modified Proctor, to ASTM D1557.
 - .5 Compact each layer from mid height of pipe to underside of backfill to at least 90% Modified Proctor, to ASTM D1557.
 - .6 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

- 3.7 Backfill
 - .1 Place backfill material in unfrozen condition.
 - .2 Place backfill material, above pipe surround in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.

- 3.8 Field Testing of Force main
 - .1 Testing of force main to be carried out in presence of the Departmental Representative.
 - .2 Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.
 - .3 Expel air from force main, by slowly filling main with water. Drill and tap high points and install suitable cocks to vent air and to be shut when pressure is applied. Remove cocks after satisfactory

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- completion of test and seal holes with tight fitting plugs.
- .4 Apply hydrostatic test pressure of 95 kPa based on elevation of lowest point in line and corrected to elevation of test gauge for hydrostatic test and 62 kPa for leakage test.
 - .5 Apply pressure for 1h for pressure test and 2h for leakage test.
 - .6 Examine exposed pipe, joints and fittings while system is under pressure.
 - .7 Remove defective joints, pipe and fittings and replace with new sound material.
 - .8 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
 - .9 Do not exceed allowable leakage.
 - .10 Locate and repair defects if leakage is greater than amount specified.
 - .11 Repeat test until leakage is within specified allowance for full length of force main.
 - .12 Complete backfill.
 - .13 Repeat test after completing backfill. Locate and repair defects and backfill. Repeat tests, repairs and backfills as needed until leakage is less than amount specified.

END OF SECTION

Penticton Airport Sanitary Lift Station Replacement

Penticton, BC

APPENDIX

Project No. R. 070315.001

A	Geotechnical Assessment Report – Penticton Airport Sanitary Lift Station Replacement – Levelton Consultants Ltd.	17 pages
B	Pre-Construction Hazard Assessment	4 pages



16 March 2015
File: R715-0343-00

Levelton Consultants Ltd.

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Metallurgy

Environmental

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Wedler Engineering LLP
#211 – 2459 Cousins Avenue
Courtenay, BC
V9N 3N6

Attention: Mr. Andrew Gower, P.Eng.
Partner, Courtenay Branch Manager

Dear Sir:

**Re: Geotechnical Assessment Report
Penticton Airport Sanitary Lift Station Replacement
Penticton, BC**

1.0 INTRODUCTION

As requested, Levelton Consultants Ltd. (Levelton) has prepared this geotechnical assessment report for the design of the above-referenced project. Our scope of work for this project was provided in our e-mail proposal P715-0296-00 dated 23 January 2015. Authorization to proceed with the scope of work presented in the proposal was received from Wedler Engineering LLP. (the Client) via e-mail on 12 February 2015.

Our scope of work did not include assessment of the soil or groundwater at the proposed lift station site with respect to environmental contaminant considerations.

2.0 PROJECT DESCRIPTION

Based on the information that has been provided to us, we understand that the project consists of the construction of the following:

- A sanitary lift station, control kiosk and genset to be located in a grassed area on the east side of Airport Road, south of the intersection of Airport Road and Dakota Avenue, at the Penticton Airport. The lift station will be located to the west of the exiting pump station. We understand that the base of the new lift station wet well will be located at least 3 m below grade. The control kiosk and genset will be supported on concrete pads at about existing grade. A paved parking area will be located adjacent to the new lift station.

The location of the proposed lift station, based on drawings provided to us by the Client, is shown on the attached Figure 1.

3.0 GEOTECHNICAL EXPLORATION

To assess the soil and groundwater conditions at the project site, on 06 March 2015 Levelton advanced one borehole (AH15-01) to a depth of 15.2 m below grade with a truck-mounted drill rig equipped with solid-stem continuous flight augers. The approximate location of the borehole is shown on Figure 1.

To assess the *in-situ* consistency / relative density of the soils at the lift station site, a Dynamic Cone Penetration Test (DCPT) was conducted adjacent to the borehole. This test is widely used by local geotechnical practitioners and involves advancing a cone into the ground using an automatic trip hammer with a weight of 63 kg and a free-fall drop of 750 mm. The number of blows required for each 305 mm interval of depth of advancement of the cone is recorded. The DCPT blow counts provide an indication of the consistency/relative density of the soils, and there are local empirical correlations of the DCPT blow counts to Standard Penetration Test (SPT) "N" values for sand soils. Local geotechnical consultant's report that the DCPT N-values data tend to provide a general 1:1 correlation with SPT N-values to a depth of about 12 m. The DCPT extended to a depth of about 15.2 m below grade, and was terminated in very stiff / dense soil.

The soil and groundwater conditions encountered at the borehole were logged in the field by a member of our geotechnical staff. Disturbed soil samples were collected from the auger flights for visual classification and moisture content testing. Five soil samples, from depths of about 2.1, 5.8, 9.8, 13.7 and 15.2 m below grade, were submitted for grain size distribution analysis.

The borehole was closed in conformance with provincial groundwater protection requirements immediately upon completion.

A soil log providing detailed description of the soil and groundwater conditions encountered at the borehole is attached to this report. The soil log also graphically shows the moisture content of soil samples collected from the borehole and the blow counts for the DCPT conducted at the borehole. The results of the grain size distribution analyses conducted on the five samples obtained from the borehole are attached following the soil logs.

4.0 SOIL AND GROUNDWATER CONDITIONS

4.1 SURFICIAL GEOLOGY

The Geological Survey of Canada surficial geology map covering the project area (Hugh Nasmith, Bulletin 46) describes the soils in the project area as beaches, spits and dunes deposits. These deposits would be anticipated to consist of silt and sand.

4.2 LEVELTON BOREHOLE

The following generalized soil profile was encountered at the borehole at the proposed lift station location:

- **Silty Sand topsoil**– extending to a depth of about 0.3 m below grade. The moisture content of a sample from this deposit was 16%. Based on the DCPT, this deposit is judged to be compact.

- **Silt, trace sand** – extending to a depth of about 0.6 m below grade. The moisture content of a sample of this layer was about 14%. Based on the DCPT, the silt is judged to be stiff.
- **Organic Silt, trace sand** – extending to a depth of about 0.8 m below grade. The moisture content of a sample of this deposit was about 145 percent, indicating a high organic content. Based on the DCPT, the organic silt is judged to be firm.
- **Sand, trace to some silt, trace fine gravel** – extending to a depth of about 4 m below grade. The moisture content of samples of this sand layer ranged from 19 to 30%. Based on the DCPT, the sand is judged to be compact to loose.
- **Silty Sand** – extending to a depth of about 7 m below grade. The moisture contents of samples of the silty sand ranged between 31 and 33%. Based on the DCPT, the silty sand is judged to be loose to compact.
- **Silt with some sand** – extending to a depth of 13.1 m. The moisture contents of samples of the silt ranged from 38 to 49%. Based on the DCPT, the silt is judged to be very stiff.
- **Sand with some silt** – extending to a depth of 14.9 m. The moisture contents of samples of the sand ranged from 24 to 27%. Based on the DCPT, the sand is judged to be compact to very dense.
- **Sandy Silt** – extending to the bottom of the borehole at a depth of 15.2 m. The moisture content of a sample of the sandy silt was 43%. Based on the DCPT, the sandy silt is judged to be very stiff.

The soils were noted to be wet below a depth of 0.6 m. We expect that the depth to groundwater fluctuates on a seasonal basis and may be influenced by the water level in Skaha Lake; however, the groundwater table is likely at relatively shallow depth (within 1 to 2 m of the ground surface) throughout the year.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Based on the information collected at AH15-01, it is anticipated that the base of the lift station wet well, which we understand will be located about 3 to 4 m below grade, will be constructed on loose to compact sand, trace silt to loose to compact silty sand. It is our opinion that pile support of the wet well will not be necessary.

Some ground improvement, in the form of excavation of the surficial silty sand topsoil, stiff silt and organic silt encountered at AH15-01 and replacement with compacted engineered fill, will be required to construct the proposed control kiosk and genset slabs.

It is expected that the excavation for construction of the proposed wet well will extend about 3 to 4 m below the groundwater table, based on the information available at the time this report was prepared. Due the presence of a saturated sand below a depth of 0.6 m, specialized temporary excavation dewatering will be required to install the lift station wet well. In addition, the wet well will need to be designed to resist buoyancy uplift forces.

5.2 EXCAVATIONS

The sides of the unsupported temporary excavation for construction of the lift station wet well should not be steeper than 1H:1V, provided that vacuum well-point dewatering is conducted prior to excavation.



Design of temporary excavation support is beyond our scope of work for this project, and should be completed by a Professional Engineer retained by the Contractor. However, we expect that a sheet pile shoring system would be suitable for temporary support of the wet well excavation, providing that the sheet piles can penetrate to sufficient depth below the base of the proposed excavation. Internal bracing or anchoring of the sheet piles would likely be required, and dewatering of the excavation would be required if this method is employed. Other excavation shoring options may be considered by the Contractor.

As an initial guideline, it is anticipated that the base of the temporary sheet pile shoring installation would need to extend into the very stiff grey silt below the bottom of the excavation. If the excavation is not fully dewatered, the sheet pile shoring system should be designed to support hydrostatic pressures based on the groundwater table at 0.6 m below the ground surface.

It is expected that conventional excavation equipment can be used to excavate the soils to the required depth for installation of the proposed lift station wet well.

5.3 GROUNDWATER CONTROL

The static water level at AH15-01 was about 0.6 m below grade at the time of drilling. Since the base of the proposed lift station wet well will be located about 3 to 4 m below grade, the excavation for construction of the wet well will encounter the groundwater table. We expect that specialized dewatering measures, such as vacuum well-points or pumped well(s), will be necessary to maintain a dry excavation for construction of the proposed lift station wet well. It is recommended that the water table be drawn down to a depth of at least 0.6 m below the base of the proposed excavation for the duration of the construction of the lift station wet well.

As there is a moderate risk that the well point dewatering could induce differential settlement of nearby facilities, the Geotechnical Engineer should be advised if dewatering of the pump station wet well excavation will be conducted. It is recommended that settlement monitoring points be established along those facilities prior to initiating dewatering using well points or other dewatering methods. The monitoring points should then be regularly surveyed for evidence of differential settlement while the dewatering system remains operational. Consideration should also be given to constructing the excavation at the lift station location during the dry season when groundwater levels may be lower.

5.4 BACKFILL

Backfill for the lift station wet well, where located below paved or other settlement-sensitive areas, should consist of well-graded granular material with a maximum of 8% fines (material passing the 0.075 mm sieve) by weight, in accordance with MMCD Volume II, Platinum Edition Pit Run Gravel (Section 31 05 17 2.3). The backfill should be placed in discrete lifts a maximum of 300 mm in thickness and be compacted to not less than 95% of the material's Modified Proctor Maximum Dry Density (MPMDD), as confirmed by in-place soil density tests.

The site soils are not recommended for re-use as backfill below settlement sensitive areas.

5.5 PAVEMENT STRUCTURE

We recommend the following pavement structure for parking and access areas adjacent to the lift station:

- 65 mm of asphalt, underlain by

- A minimum of 150 mm of 19 mm minus crushed gravel base course, underlain by
- A minimum of 400 mm of 75 mm minus pit-run sand and gravel sub-base course, underlain by,
- Geotechnical Engineer approved subgrade.

Appropriate subgrade would consist of the native loose to compact sand.

The sub-base and base course materials should conform to the specifications contained in Volume II of the MMCD Platinum Edition (Section 31 05 17 2.8 Select Granular Sub-base and 31 05 17 2.10 Granular Base).

The sub-base and base courses should be compacted to not less than 95% of their MPMDD, as confirmed by in-place soil density testing.

5.6 LIFT STATION WET WELL DESIGN

5.6.1 Foundations

Based on the information obtained from AH15-01, it is anticipated that the soils at the elevation of the lift station wet well foundation, located about 3 to 4 m below grade, will consist of loose to compact sand, trace silt to silty sand.

Assuming that a shallow reinforced concrete mat foundation is deemed to be suitable for the support of the lift station wet well, the subgrade should be covered with 300 mm of 19 mm clear crushed gravel placed over a non-woven geotextile such as Nillex 4551 or Geotechnical Engineer approved equivalent to protect the subgrade from disturbance during foundation construction.

The foundation for the wet well constructed on the clear crushed gravel over loose to compact sand / silty sand subgrade can be designed based on a serviceability limit state (SLS) soil bearing resistance of 100 kPa and a factored ultimate limit state (ULS) soil bearing resistance of 150 kPa. The Geotechnical Engineer should review the exposed subgrade to confirm that the soils can provide the SLS and factored ULS values provided in this report.

The soil below the wet well foundation is not expected to be subject to liquefaction during a design magnitude seismic event (1 in 2475 year event). If required, we recommend that Site Class "D" conditions be used for seismic design of the wet well foundation.

5.6.2 Lateral Earth Pressures

It is anticipated that the below-grade walls of the wet well structure will be sufficiently rigid such that "at-rest" lateral earth pressures would be generated. For static loading, it is recommended that the unfactored lateral earth pressure be computed using an equivalent fluid unit weight of 9 kPa/m for the design based on "at-rest" lateral earth pressure.

A uniformly distributed lateral load of 5 kPa should be included to model temporary construction live loads. The uniformly distributed load will act over the total height of the below-grade walls.

Lateral pressures resulting from other surcharge loading applied at the ground surface adjacent to the wet well should be calculated based on an "at-rest" earth pressure co-efficient of 0.4. The lateral earth pressure from the surcharge loading will be uniformly distributed over the total height of the below-grade walls.



Hydrostatic pressures should be included for the static loading condition based on the groundwater table being located 0.6 m below grade.

The total seismic earth pressure for design of the wet well was estimated using the pseudo-static Mononobe-Okabe¹ (M-O) equations. Based on research by Atik and Sitar², Levelton estimated the seismic coefficient input into the M-O analysis to be 65 percent of the site specific Peak Ground Acceleration (PGA). The Atik and Sitar research findings, which included detailed numerical modeling, experiments, and the review of actual retaining wall performance after severe earthquake shaking in California, Chile, China, and Japan, determined that retaining walls generally perform well during earthquakes. This is likely due to out of phase shaking between the soil and retaining walls. Furthermore, their research indicates that the resultant of the pseudo-static seismic force acts approximately 1/3H above the base of the wall, where H is the wall height. Based on these findings, Levelton recommends a triangular pressure distribution with an equivalent fluid unit weight of 10 kPa/m be used to estimate the unfactored total seismic force (i.e. soil load plus earthquake load).

The values provided above assume:

- The wall backfill consists of compacted, free-draining granular material as defined in Section 5.4 of this report;
- Vertical wet well walls; and
- Level backfill adjacent to the wet well.

5.6.3 Buoyancy Considerations

The proposed construction will be subject to uplift pressures associated with an increase in the elevation of the water table above the base of the structure. This may occur during periods of prolonged precipitation, when it is anticipated that the groundwater table could rise to near the ground surface. Consequently, it is considered prudent to design the proposed construction to resist buoyancy uplift forces, based on a groundwater table at the ground surface.

The buoyancy uplift force may be resisted by the weight of the structure plus a frictional resistance between the structure and the surrounding soil. For a concrete structure, the concrete to soil interface friction angle is estimated to be 24 degrees. For a fiberglass structure, the fiberglass to soil interface friction angle is estimated to be 20 degrees. These values assume that granular soil is used as backfill. The coefficient of friction can be taken as the tangent of the friction angle.

The buoyancy uplift force may also be resisted by extending the foundation of the structure horizontally beyond the outside edges of the structure or by placing concrete ballast around the lift station foundation. This utilizes the weight of the soil above the foundation extension to resist the uplift forces. The buoyant unit weight of the granular backfill soil may be taken as 9 kN/m³ for considering the resistance to uplift.

5.7 CONTROL KIOSK AND GENSET SLABS

Site preparation in the areas of the proposed control kiosk and genset slabs at the lift station site should consist of the removal of any vegetation and topsoil, followed by over-excavation to remove organic soils and expose the native sand subgrade. Engineered fill should then be placed over the

¹ Mononobe, N and Matsuo M (1929). "On the Determination of Earth Pressures During Earthquakes" Proc. World Eng. Congress, 9, pp 179 -187

² Atik, L. and Sitar, N., (2010) "Seismic Earth Pressures on Cantilever retaining Structures" ASCE Journal of Geoenvironmental and Geotechnical Engineering, October 2010



Geotechnical Engineer approved subgrade to support the slabs. Based on the borehole, stripping depths of about 0.8 m are expected to be required to remove the unsuitable surficial soils and expose the sand subgrade. Greater or lesser stripping depths may be required in localized areas.

We recommend that there be a minimum of 0.5 m of engineered fill below the underside of the slabs. The engineered fill should extend horizontally beyond the edges of the slabs a minimum of 0.5 m. The engineered fill should consist of well-graded granular material with less than 8% fines (material passing the 0.075 mm sieve) such as pit run sand and gravel. The Geotechnical Engineer should be provided with the opportunity to review candidate engineered fill materials to assess their suitability prior to use. If the water table is exposed during excavation, then initially clear crushed rock should be placed atop the subgrade to above the water table, followed by a non-woven geotextile separator such as Nillex 4551 or Geotechnical Engineer approved equivalent, followed by the engineered fill.

The engineered fill should be placed in discrete lifts a maximum of 300 mm in thickness and be compacted to not less than 100 percent of the material's Standard Proctor Maximum Dry Density (SPMDD), as confirmed by in-place soil density tests conducted by the Geotechnical Engineer.

Slabs constructed on the compacted engineered fill can be designed based on an SLS soil bearing resistance of 100 kPa and a factored ULS of 150 kPa.

6.0 GEOTECHNICAL ENGINEERING REVIEW

We recommend that the Geotechnical Engineer be provided with the opportunity to review the following during construction:

- Imported backfill and engineered fill materials;
- Placement and compaction of backfill and pavement sub-base and base course materials;
- Subgrade at the wet well and control kiosk / genset slabs; and
- Placement and compaction of engineered fill for the control kiosk / genset slabs.

7.0 CLOSURE

This geotechnical report has been prepared by Levelton Consultants Ltd. exclusively for Wedler Engineering LLP and their appointed agents. We acknowledge that the Public Works and Government Services Canada (PWGSC) and members of PWGSC's consultant design team are also authorized users of this report. The opinions, conclusions and recommendations provided in this report reflect our judgement in light of the information available to us at the time that it was prepared.

Any use of this report by third parties, or any reliance on or decisions made based on it, are the responsibility of such third parties. Levelton does not accept responsibility for damages suffered, if any, by a third party as a result of their use of this report.

The soil log attached to this report provides description of the soil and groundwater conditions encountered at a discrete borehole location. Actual soil conditions in areas remote from the borehole may vary. Contractors should make their own interpretation of the soil log and the site conditions for the purposes of bidding and performing work at the site.

The attached Terms of Reference form an integral part of this report.



We trust that the information presented in this report meets your immediate requirements. If you have any questions or require additional information, please do not hesitate to contact us at your convenience.

LEVELTON CONSULTANTS LTD.

Original Signed By

Per: Paul Ell, P Eng
Senior Geotechnical Engineer

Reviewed by: Michael Gutwein, P Eng
Senior Geotechnical Engineer

Attachments: Terms of Reference
Figure 1
Soil Log
Grain Size Distribution Analysis Reports

TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY LEVELTON CONSULTANTS LTD.

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Levelton Consultants Ltd. ("Levelton") prepared and issued this geotechnical report (the "Report") for its client (the "Client") in accordance with generally-accepted engineering consulting practices for the geotechnical discipline. No other warranty, expressed or implied, is made. Unless specifically stated in the Report, the Report does not address environmental issues.

The terms of reference for geotechnical reports issued by Levelton (the "Terms of Reference") contained in the present document provide additional information and caution related to standard of care and the use of the Report. The Client should read and familiarize itself with these Terms of Reference.

2. COMPLETENESS OF THE REPORT

All documents, records, drawings, correspondence, data, files and deliverables, whether hard copy, electronic or otherwise, generated as part of the services for the Client are inherent components of the Report and, collectively, form the instruments of professional services (the "Instruments of Professional Services"). The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to Levelton by the Client, the communications between Levelton and the Client, and to any other reports, writings, proposals or documents prepared by Levelton for the Client relative to the specific site described in the Report, all of which constitute the Report.

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TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS
ISSUED BY LEVELTON CONSULTANTS LTD. (continued)

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- a. **Nature and Exactness of Descriptions:** The classification and identification of soils, rocks and geological units, as well as engineering assessments and estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1 above. The classification and identification of these items are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations or assessments utilizing the standards of Paragraph 1 involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to changes over time and the parties making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or when the Client has special considerations or requirements, the Client must disclose them to Levelton so that additional or special investigations may be undertaken, which would not otherwise be within the scope of investigations made by Levelton or the purposes of the Report.
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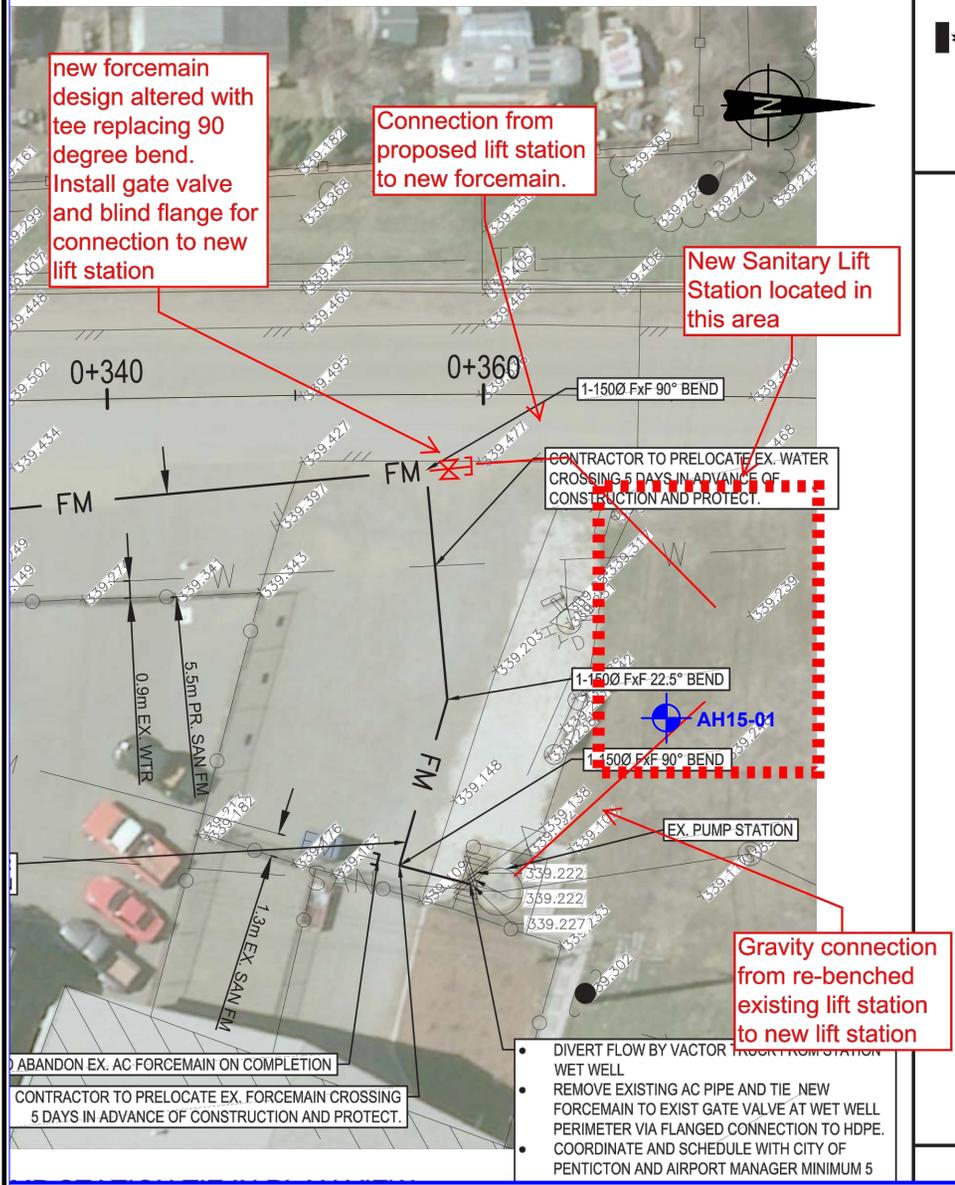
6. ALTERNATE REPORT FORMAT

When Levelton submits both electronic and hard copy versions of the Instruments of Professional Services, the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding upon Levelton. The hard copy versions submitted by Levelton shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions; furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed and sealed versions of the Instruments of Professional Services maintained or retained, or both, by Levelton shall be deemed to be the overall originals for the Project.

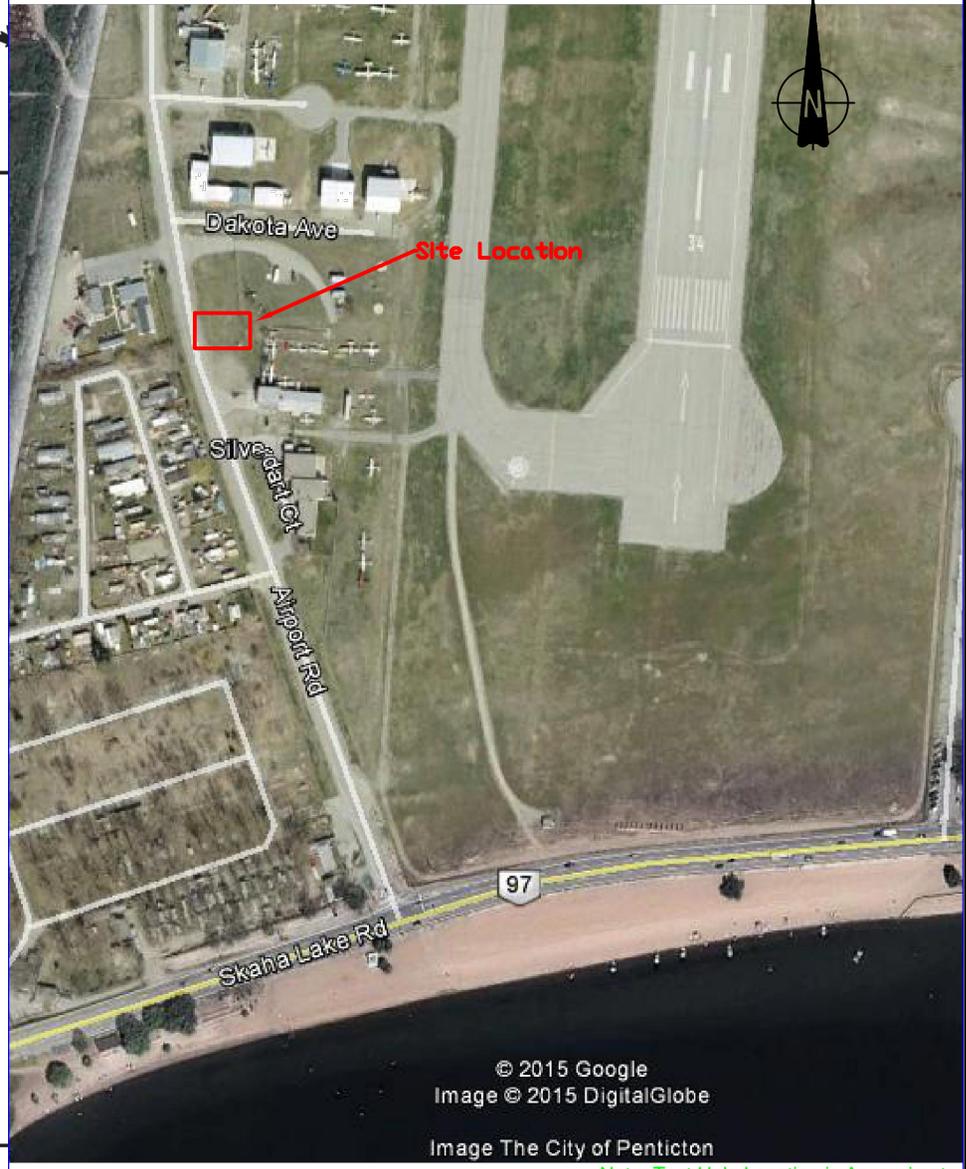
The Client agrees that the electronic file and hard copy versions of Instruments of Professional Services shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Levelton. The Client warrants that the Instruments of Professional Services will be used only and exactly as submitted by Levelton.

The Client recognizes and agrees that Levelton prepared and submitted electronic files using specific software or hardware systems, or both. Levelton makes no representation about the compatibility of these files with the current or future software and hardware systems of the Client, the Approved Users or any other party. The Client further agrees that Levelton is under no obligation, unless otherwise expressly specified, to provide the Client, the Approved Users and any other party, or any or all of them, with specific software and hardware systems that are compatible with any electronic submitted by Levelton. The Client further agrees that should the Client, an Approved User or a third party require Levelton to provide specific software or hardware systems, or both, compatible with the electronic files prepared and submitted by Levelton, for any reason whatsoever included but not restricted to an order from a court, then the Client will pay Levelton for all reasonable costs related to the provision of the specific software or hardware systems, or both. The Client further agrees to indemnify and hold harmless Levelton, its officers, directors, employees, agents, representative or sub-consultant, or any or all of them, against any claim or any nature whatsoever brought against Levelton, whether in contract or in tort, arising or related to the provision or use or any specific software or hardware provided by Levelton.

Site Plan



Site Location



© 2015 Google
Image © 2015 DigitalGlobe
Image The City of Penticton

Note: Test Hole Location is Approximate

LEGEND	AHXX-X	AUGER HOLE

ADAPTED FROM		N/A
DATE	PROJECT NO.	
N/A	N/A	
<small>This drawing is the sole property of Levelton Consultants Ltd. and cannot be used or duplicated in any way without the expressed written consent of Levelton Consultants. The general contractor shall verify all dimensions and report any discrepancies to Levelton Consultants Ltd.</small>		



LEVELTON
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Kelowna, BC, V1X 5C3
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f:250-491-9729
www.levelton.com

TITLE	Site Location and Site Plan	
PROJECT	Penticton Airport Lift Station Replacement	
ADDRESS	Airport Road, Penticton BC	
CLIENT	Wedler Engineering Llp.	

DSN	SCALE
	NTS
CHK	DATE
PE	March 10, 2015
DWN	PROJECT NO.
TD	R715-0343-00
	DRAWING NO.
	FIGURE 1



Levelton Consultants Ltd.
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 Kelowna, B.C. V1X 5C3
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 Fax: 250-491-9729
 www.levelton.com

Airport Road
 Penticton, BC
 Lift Station Replacement

AH15-01

Pg 1 of 1

Project No: R715-0343-00

Northing: 311119 Easting: 5481320

Depth (m) (ft)	Description	C	N	Type	Water Level	10	20	30	40	50	60	70	80	90
0	Compact brown silty SAND, topsoil, moist.			G										
0.5	Stiff tan SILT, trace sand, moist.			G										
1	Firm brown organic SILT, trace sand, wet.			G										
2	Compact to loose grey SAND, trace to some silt, trace fine gravel, wet.			G										
4	Loose to compact grey silty SAND, wet.			G										
6				G										
8				G										
10				G										
12	Very stiff grey SILT, some sand, wet.			G										
14				G										
16				G										
18				G										
20	Compact to very dense grey SAND, some silt, trace gravel, wet.			G										
22				G										
24				G										
26				G										
28	Very stiff grey sandy SILT, wet.			G										
30				G										
32	Bottom of hole at 15.24 meters													
34														

Mar 6 2015
 MC = 144.6%

1 LOG PER PAGE R715-0343-00 SOIL LOG DRAFT.GPJ LEVELTON.GDT 16/3/15

C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby FP : Fixed Piston G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type: Trip Hammer DYNAMIC CONE PENETRATION TEST: Blow Count: Number of blows of a 140 lb (64 kg) hammer dropped 30in. (750mm) to produce 12in. (300mm) of penetration of a 2in. (50mm) diameter cone.	● Moisture Content % ▲ Plastic Limit % ▼ Liquid Limit % ▼ Ground Water Level ⊗ Shear strength in kPa (Torvane or Penetrometer) ⊗ Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (field vane) ⊗ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Solid Stem Auger / DCPT Date Drilled: 06/03/2015 By: TD
---	--	--	---	--

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
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Fraser Valley Group and Southern Interior



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Tel: (250) 491-9778
Fax: (250) 491-9729
Email: kelowna@levelton.com

Client: Wedler Engineering LLP
Project: Penticton Airport Lift Station
Site Address: Airport Road, Penticton, BC

File No.: R715-0343-00
Task:

Report of Grain Size Analysis

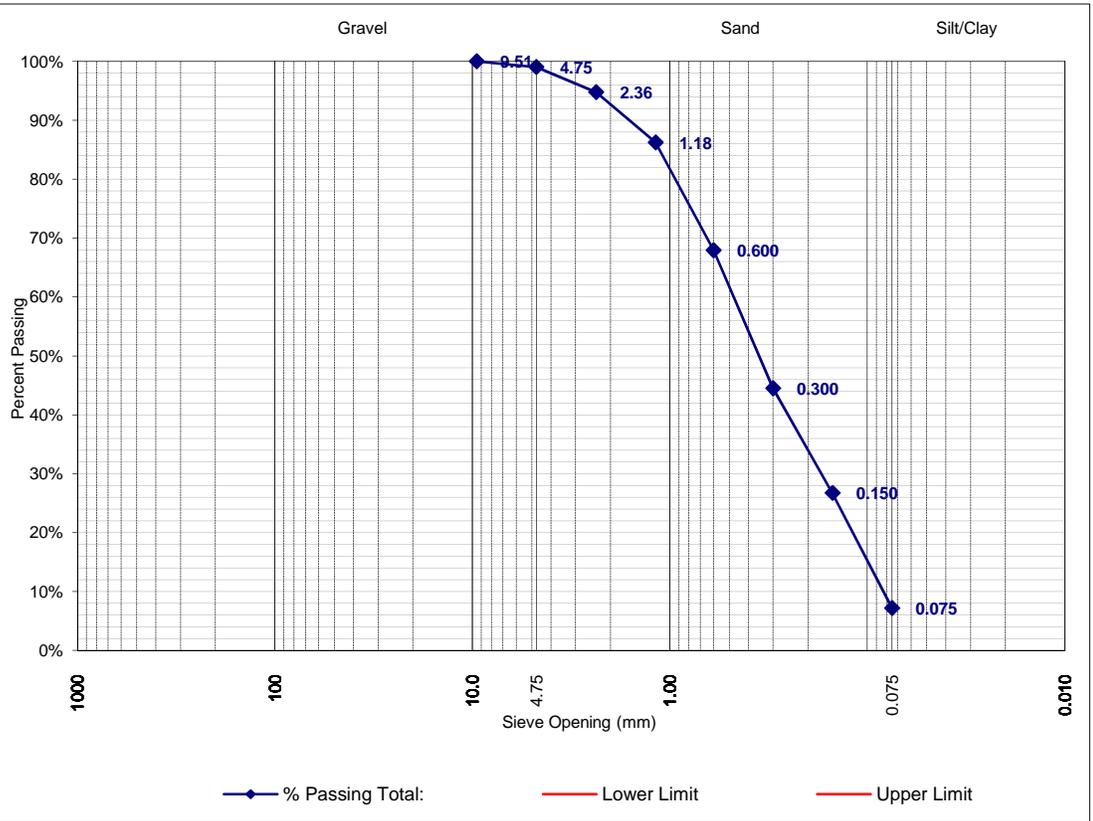
Sample Location: AH15-01 - G5 2.1m
Supplier:
Material Type: SAND, trace silt, trace gravel
Usage:
Specification:

Sampled By: TD
Tested By: MP
Date Sampled: March 6, 2015
Date Tested: March 10, 2015
Sieve No. 1

Moisture Content (as received): 20%

Washed Sieve

Screen Opening (mm):	% Passing Total:	Specification	
		Upper Limit	Lower Limit
150.0			
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5			
9.51	100.0%		
4.75	99.0%		
2.36	94.8%		
1.18	86.2%		
0.600	67.9%		
0.425			
0.300	44.5%		
0.150	26.7%		
0.075	7.2%		



Remarks: _____

Levelton Consultants Ltd.

Reporting of these results constitutes a testing service only.
No engineering interpretation of the results is expressed or implied.
Engineering review and interpretation of these results can be provided upon written request.

Per: _____

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Client: Wedler Engineering LLP
Project: Penticton Airport Lift Station
Site Address: Airport Road, Penticton, BC

File No.: R715-0343-00
Task:

Report of Grain Size Analysis

Sample Location: AH15-01 - G10 5.8m

Supplier:

Material Type: Silty SAND

Usage:

Specification:

Moisture Content (as received): 31%

Sampled By: TD

Tested By: MP

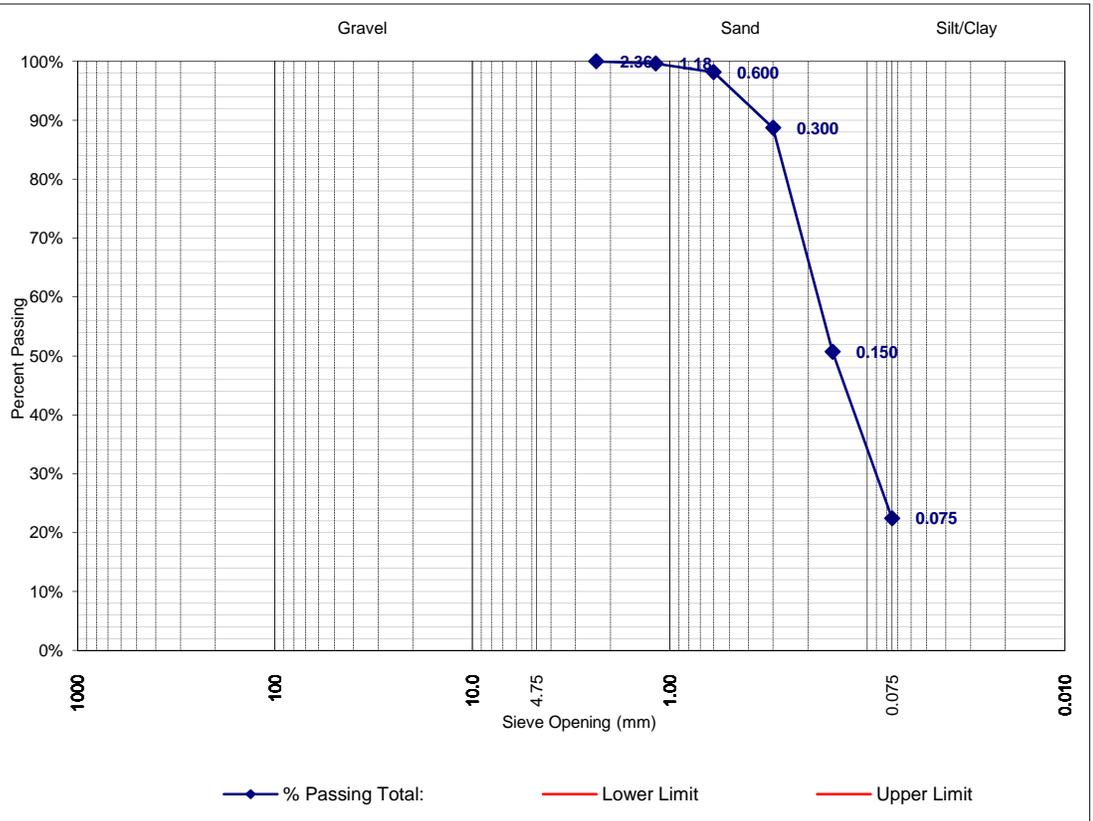
Date Sampled: March 6, 2015

Date Tested: March 10, 2015

Sieve No. 2

Washed Sieve

Screen Opening (mm):	% Passing Total:	Specification	
		Upper Limit	Lower Limit
150.0			
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5			
9.51			
4.75			
2.36	100.0%		
1.18	99.6%		
0.600	98.2%		
0.425			
0.300	88.7%		
0.150	50.7%		
0.075	22.4%		



Remarks: _____

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Email: kelowna@levelton.com

Client: Wedler Engineering LLP
Project: Penticton Airport Lift Station
Site Address: Airport Road, Penticton, BC

File No.: R715-0343-00
Task:

Report of Grain Size Analysis

Sample Location: AH15-01 - G15 9.8m

Supplier:

Material Type: SILT, some sand

Usage:

Specification:

Moisture Content (as received): 46%

Sampled By: TD

Tested By: MP

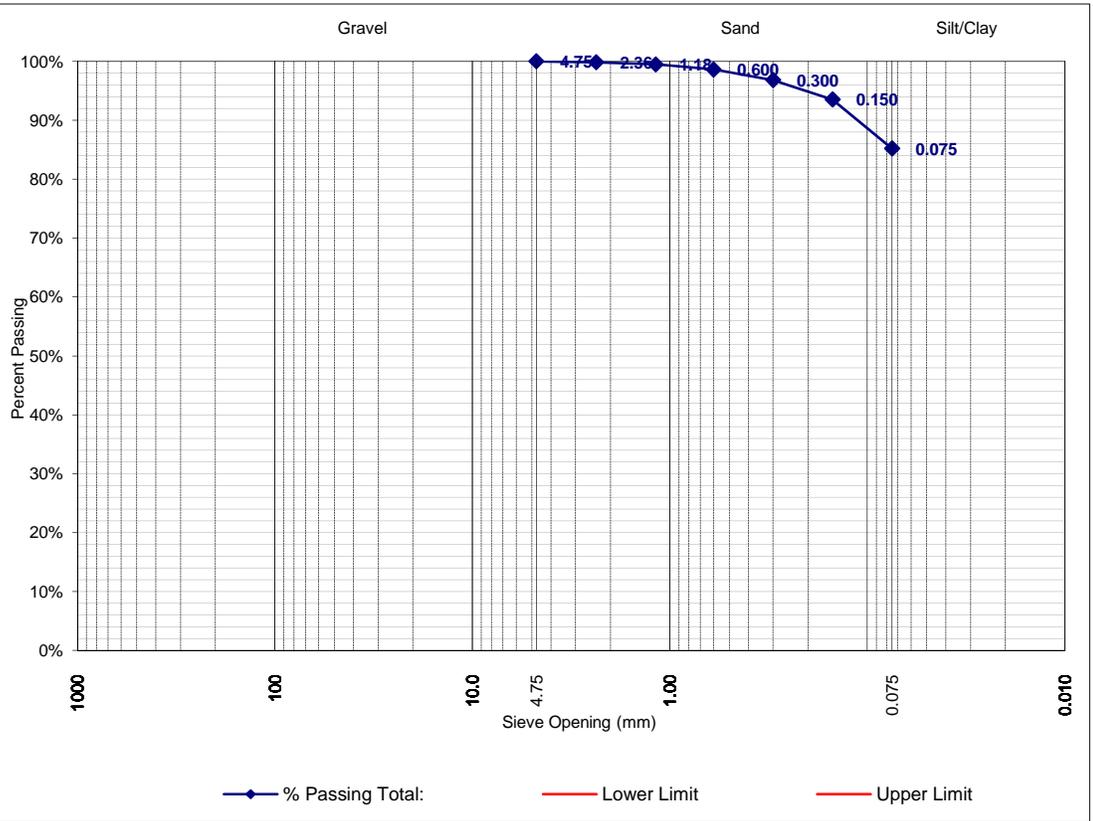
Date Sampled: March 6, 2015

Date Tested: March 10, 2015

Sieve No. 3

Washed Sieve

Screen Opening (mm):	% Passing Total:	Specification	
		Upper Limit	Lower Limit
150.0			
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5			
9.51			
4.75	100.0%		
2.36	99.9%		
1.18	99.5%		
0.600	98.6%		
0.425			
0.300	96.8%		
0.150	93.5%		
0.075	85.2%		



Remarks: _____

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Tel: (250) 491-9778
Fax: (250) 491-9729
Email: kelowna@levelton.com

Client: Wedler Engineering LLP
Project: Penticton Airport Lift Station
Site Address: Airport Road, Penticton, BC

File No.: R715-0343-00
Task:

Report of Grain Size Analysis

Sample Location: AH15-01 - G22 15.2m

Supplier:

Material Type: Sandy SILT

Usage:

Specification:

Moisture Content (as received): 43%

Sampled By: TD

Tested By: MP

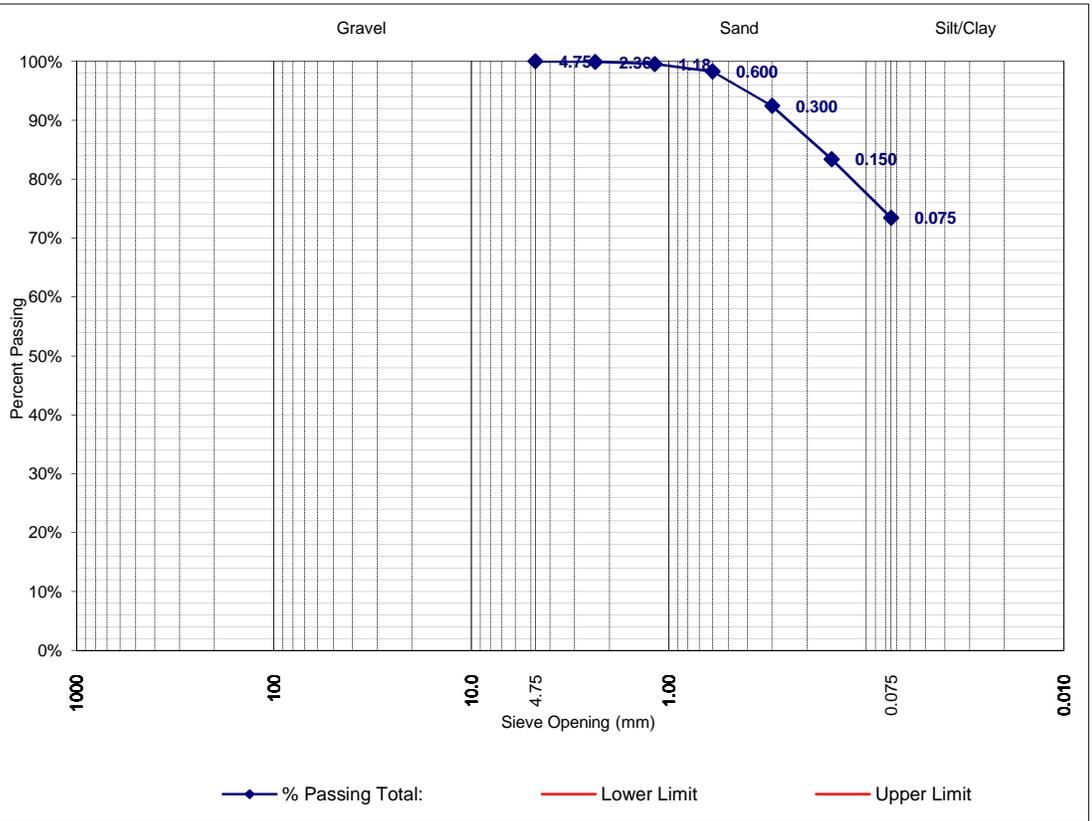
Date Sampled: March 6, 2015

Date Tested: March 10, 2015

Sieve No. 5

Washed Sieve

Screen Opening (mm):	% Passing Total:	Specification	
		Upper Limit	Lower Limit
150.0			
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5			
9.51			
4.75	100.0%		
2.36	99.9%		
1.18	99.5%		
0.600	98.3%		
0.425			
0.300	92.5%		
0.150	83.4%		
0.075	73.5%		



Remarks: _____

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No engineering interpretation of the results is expressed or implied.
Engineering review and interpretation of these results can be provided upon written request.

Per: _____



PRELIMINARY HAZARD ASSESSMENT FORM

Project Number:	R. 070315.001
Location:	Airport Access Road, Penticton, BC
Date:	May 01, 2015
Name of PWGSC Departmental Representative and Senior Project Manager:	Monique Simard PH: (604) 816-8004
Name of Client:	Transport Canada
Name of Client Project Co-ordinator	Stephen Lai

Site Specific Orientation Provided at Project Location Yes No

Notice of Project Required Yes No

NOTE:
PWGSC REQUIRES A Notice of Project FOR ALL CONSTRUCTION WORK RELATED ACTIVITIES

NOTE:
OHS law is made up of many municipal, provincial, and federal acts, regulations, bylaws and codes. There are also many other pieces of legislation in British Columbia that impose OHS obligations.

Important Notice: This hazard assessment has been prepared by PWGSC for its own project planning process, and to inform the service provider of actual and potential hazards that may be encountered in performance of the work. PWGSC does not warrant the completeness or adequacy of this hazard assessment for the project and the paramount responsibility for project hazard assessment rests with the service provider.

TYPES OF HAZARDS TO CONSIDER	Potential Risk for:				COMMENTS
	PWGSC, OGD's, or tenants		General Public or other contractors		
Examples: Chemical, Biological, Natural, Physical, and Ergonomic Listed below are common construction related hazards. Your project may include pre-existing hazards that are not listed. Contact the Regional Construction Safety Coordinator for assistance should this issue arise.	Yes	No	Yes	No	Note: When thinking about this pre-construction hazard assessment, remember a hazard is anything that may cause harm, such as chemicals, electricity, working from heights, etc; the risk is the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.



Typical Construction Hazards					
Concealed/Buried Services (electrical, gas, water, sewer etc)	Yes		Yes		
Slip Hazards or Unsound Footing	Yes		Yes		
Working at Heights	Yes		Yes		Installing lamp standard
Working Over or Around Water		No		No	
Heavy overhead lifting operations, mobile cranes etc.	Yes		Yes		
Marine and/or Vehicular Traffic (site vehicles, public vehicles, etc.	Yes		Yes		
Fire and Explosion Hazards	Yes		Yes		
High Noise Levels	Yes		Yes		
Excavations	Yes		Yes		
Blasting		No		No	
Construction Equipment	Yes		Yes		
Pedestrian Traffic (site personnel, tenants, visitors, public)	Yes		Yes		
Multiple Employer Worksite	Yes		Yes		Example: Contractor working in an occupied Federal Employee space.
Electrical Hazards					Comments
Contact With Overhead Wires	Yes		Yes		
Live Electrical Systems or Equipment	Yes		Yes		
Other:					
Physical Hazards					
Equipment Slippage Due To Slopes/Ground Conditions	Yes		Yes		
Earthquake	Yes		Yes		
Tsunami		No		No	
Avalanche		No		No	
Forest Fires	Yes		Yes		
Fire and Explosion Hazards	Yes		Yes		
Working in Isolation		No		No	
Working Alone		No		No	
Violence in the Workplace	Yes		Yes		
High Noise Levels	Yes		Yes		
Inclement weather	Yes		Yes		
High Pressure Systems		No		No	
Other:					
Hazardous Work Environments					
Confined Spaces / Restricted Spaces					Review and provide confined space assessment(s) from PWGSC or client confined space inventories. Refer to PWGSC Standard on Entry into Confined Spaces. Contact the Regional Construction Safety Coordinator.
Suspended / Mobile Work Platforms		No		No	
Other:					



Biological Hazards					
Mould Proliferations		No		No	
Accumulation of Bird or Bat Guano		No		No	
Bacteria / Legionella in Cooling Towers / Process Water		No		No	
Rodent / Insect Infestation		No		No	
Poisonous Plants		No		No	
Sharp or Potentially Infectious Objects in Wastes	Yes		Yes		
Wildlife	Yes		Yes		
Chemical Hazards					
Asbestos Materials on Site	Yes		Yes		Limited to existing underground piping. Extent TBD. Contractor directed to follow procedures contained in Section 02 82 00.02 – Asbestos Abatement
Designated Substance Present		No		No	
Chemicals Used in work	Yes		Yes		
Lead in paint					TBD
Mercury in Thermostats or Switches					TBD
Application of Chemicals or Pesticides		No		No	
PCB Liquids in Electrical Equipment		No		No	
Radioactive Materials in Equipment		No	Yes		Nuclear Densometer for compaction testing.
Other:					
Contaminated Sites Hazards					
Hazardous Waste		No		No	
Hydrocarbons		No		No	
Metals	Yes		Yes		Steel fencing, pumps, misc.
Other:					
Security Hazards					Comments
Risk of Assault		No		No	
Other:					
Other Hazards					



Other Compliance and Permit Requirements¹	YES	NO	Notes / Comments²
Is a Building Permit required?		No	
Is an Electrical permit required?	Yes		
Is a Plumbing Permit required?		No	
Is a Sewage Permit required?		No	
Is a Dumping Permit required?			TBD (Materials to be disposed at an offsite disposal facility)
Is a Hot Work Permit required?			TBD
Is a Permit to Work required?	Yes		
Is a Confined Space Entry Permit required?			TBD
Is a Confined Space Entry Log required			TBD
Discharge Approval for treated water required		No	

Notes:

- (1) Does not relieve Service Provider from complying with all applicable federal, provincial, and municipal laws and regulations.
- (2) TBD means To Be Determined by Service Provider.

Service Provider Acknowledgement: We confirm receipt and review of this Pre-Project Hazard Assessment and acknowledge our responsibility for conducting our own assessment of project hazards, and taking all necessary protective measures (which may exceed those cited herein) for performance of the work.			
Service Provider Name			
Signatory for Service Provider		Date Signed	
RETURN EXECUTED DOCUMENT TO PWGSC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING			