Drawings :

Crandell Mountain Campground Reconstruction – Stage 1 - Issued for Tender Rev T0.

Appendices:

A. Building Specification Manual – Parks Canada – Crandell Mountain Campground Waterton Lakes National Park - Issued for Tender – February 2020
B. Standard CMS Translations Rev 2 - July 2018
C. Construction Signage Translation Rev 2 – July 2018
D. Water Well Location Sketch
E. Crandell Mountain Campground Reconstruction Waterton Lakes National Park, Alberta Geotechnical Assessment – December 2019
F. Crandell Mountain Campground Reconstruction – Construction Environmental Management Plan – March 5, 2020
G. Pit Run Moisture Content – February 2020
H. Pit Run Sieve Analysis – February 2020
I. Waterton Avalanche Safety Plan – 2016
J. Waterton Avalanche Path Map - 2018

01 11 00 SUMMARY OF WORK

Part 1 General

1.1 PRECEDENCE

.1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 DEFINITIONS

.1 Alberta Transportation is referred to as "AT".

.1 The latest version of the AT Standard Specifications for Highway Construction is to be used.

.2 Changes in Definition, - The following changes in definitions have been made to the "AT Specifications":

.1 Consultant – The word "Consultant" shall mean Departmental Representative or their duly appointed representative.

.2 Department – The word "Department" shall mean Parks Canada Agency.

.3 Waterton Lakes National Park of Canada is referred to as "WLNP".

.4 Parks Canada Agency is referred to as "PCA".

.5 Environmental Surveillance Officer is referred to as "ESO".

.6 Watercourse is as defined in the National Parks Act.

.7 Site means the areas on or within the limits of Construction as referenced on the Drawings and/or described in the Contract Documents.

.8 Work means the provision of all labour, services, material, and equipment as necessary for the Contractor to complete and perform its obligations in accordance with the Contract.

1.3 PROJECT LOCATION

.1 The project is located in Crandell Mountain Campground, Waterton Lakes National Park, Alberta. The following are key locations relative to the project:

.1 Red Rock Parkway km 0 – Hwy 5 Intersection

.2 Red Rock Parkway km 0.4 – Gated Access Road / SMS Pit

.3 Red Rock Parkway km 5.0 – Native History Pullout

.4 Red Rock Parkway km 6.8 – Crandell Mountain Campground Access

.5 Red Rock Parkway km 7.8 – Coppermine Creek Picnic Site

.6 Red Rock Parkway km 8.0 – Canyon Camp Access

.7 Red Rock Parkway km 11.7 – Lost Horse Creek

.8 Red Rock Parkway km 13.8 – Blakiston Falls Day Use

.9 Red Rock Parkway km 14.1 – Red Rock Canyon Parking Lot

1.4 WORK COVERED BY CONTRACT DOCUMENTS

.1 All requirements noted within the Contract Documents shall be completed by the Contractor unless specifically stated otherwise.

.2 Without limiting the scope of work, the work of this Contract generally comprises the following, as directed by the Departmental Representative:

.1 Installation and maintenance of temporary barriers and supply and installation of temporary traffic control and other temporary construction facilities required for the Work.

.2 Traffic signage, control and other traffic accommodations in accordance with Section 01 35 31 – Special Procedures for Traffic Control.

.3 Installation of required environmental controls, in accordance with Section 01 35 43 – Environmental Procedures.

.4 Full depth asphalt pavement removal in accordance with Section 02 41 13 – Asphalt Pavement Removal.

.5 Removal and disposal of items in accordance with Section 02 41 99 – Demolition for Minor Works.

.6 Concrete forming for Cast-in-Place Concrete in accordance with Section 03 10 00 – Concrete Forming and Accessories.

.7 Cast-in-place concrete for thrust blocks, and other works in accordance with Section 03 20 00 – Cast-in-place Concrete.

.8 Supply, construction and installation of a water treatment plant in accordance with Section 13 34 23 – Water Treatment Plant.

.9 Electrical works in accordance with Division 26.

.10 Screening of native excavation for production of AT Des 6 Class 80 aggregate in accordance with Section 31 05 16 – Aggregate Production.

.11 Grubbing of areas designated in the Contract documents in accordance with Section 31 11 00 – Clearing and Grubbing.

.12 Excavating for utility works in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.13 Stripping of organic material designated in the Contract documents and in accordance with Section 31 24 13 – Stripping and Excavation.

.14 Excavating all types of material from the cuts, hauling and placing this material in embankments or in stockpiles designated in the Contract Documents and in accordance with Section 31 24 13 – Stripping and Excavation.

.15 Supply and installation of geotextiles for use in the pavement structure and culvert works in accordance with Section 31 32 19 – Geotextiles.

.16 Protection of existing vegetation to remain in accordance with Section 32 01 90.33 – Tree and Shrub Preservation.

.17 Screen from native excavation, load, haul and place sub-base and base course materials in accordance with Section 32 11 24 – Granular Base Course and Section 32 11 20 – Gravel Fill.

.18 Supply and installation of gravel for surfacing in accordance with Section 32 15 40 – High Fines Granular Surfacing Aggregate .

.19 Prepare Owner supplied seed for hydro-mulch and place on finished slopes in accordance with Section 32 92 22 –Seeding and Hydro-Mulching.

.20 Planting in accordance with Section 32 93 10 – Trees, Shrubs and Ground Cover Planting.

.21 Supply and installation of manholes in accordance with Section 33 05 15 – Manholes and Drywell Structures.

.22 Watermains and services in accordance with Section 33 14 16 – Site Water Utility Distribution Piping.

.23 Supply and installation of the Potable Water Reservoir in accordance with Section 33 16 00 – Water Utility Storage Tanks.

.24 Drilling, pump installation and all testing for water supply production and observation wells in accordance with Section 33 21 00 – Water Supply Wells.

.25 Sewer systems in accordance with Section 33 31 11 – Public Sanitary Sewerage Gravity Piping.

.26 Sewer force mains in accordance with Section 33 31 23 – Sanitary Sewerage Force Main Piping.

.27 Septic tanks in accordance with Section 33 36 00 – Wastewater Utility Storage Tanks.

.28 Septic fields in accordance with Section 33 36 33 – Utility Drainage Field.

.29 Remove and dispose of existing CSP culverts in accordance with Section 33 42 13 – Pipe Culverts.

.30 Supply and installation of new CSP culverts in accordance with Section 33 42 13 – Pipe Culverts.

.31 Architectural requirements in accordance with Appendix A.

.32 Miscellaneous Additional Work as directed by the Departmental Representative.

.3 The Contractor will not be permitted to set up a crushing plant within the National Parks.

.4 The Contractor may source water from the existing well, as required for the works, up to 20m3/day. Note, there is no pump in the well or available power supply, and the water table is approximately 5 mbgs. Accessing water can be coordinated through the Departmental Representative and the ESO but will require the Contractor to obtain a Restricted Access Permit and to adhere to all conditions contained therein.

.5 If the Contractor requires additional water, they are responsible for sourcing water and may be required to obtain it from outside of the National Parks. Accessing local water sources in nearby pits or from other Parks facilities can be coordinated through the Departmental Representative and the ESO but will require the Contractor to obtain a Restricted Access Permit and to adhere to all conditions contained therein.

.6 There is no power available onsite, the Contractor shall provide generators or other temporary sources of power for purposes of completing all works.

.7 In preparation for and during construction of this project, an "Environmental Protection Plan" (EPP) is to be prepared by the Contractor to meet the requirements of Section 01 35 43 – Environmental Procedures to ensure the desired minimal adverse effects are achieved. The Contractor's EPP must be approved by Parks Canada Agency prior to the commencement of construction. The Departmental Representative and Parks Canada's Environmental Surveillance Officer (ESO) will refer to the approved EPP in determining compliance with the Plan and Contract Documents. The EPP will form part of the Contract.

.8 Where material and construction specifications for work covered under the Contract, including any Change Orders are not available, **AT - Standard Specifications for**

Highway Construction (latest edition) shall apply unless directed otherwise by the Departmental Representative.

1.5 CONTRACT METHOD

.1 Construct Work under combined price Contract.

1.6 WORK BY OTHERS

.1 The Contractor is advised that the following Work and anticipated completion in the vicinity has been or will be contracted by Parks Canada:

.1 Red Rock Canyon DUA

.2 Contaminated sites clean up

.3 Crandell Lake Trail design and construction

.4 DUA Reconstruction (Coppermine and Lost Horse)

.5 Other projects and maintenance works may occur in WLNP in 2021.

.2 Where it is necessary that work is to proceed in areas of this project common to both the Contractor and forces of others, the Contractor shall cooperate with the other Contractors and the PCA Departmental Representative in reviewing their construction schedules and sharing their work space, and shall coordinate their operations with the other Contractors, including traffic management and construction staging.

.3 The Contractors shall coordinate all work on this project with other Contractors including Site Safety and Traffic Control.

.4 The borrow, staging areas and pits mentioned in the Contract Documents are operational and are used by many contractors and Parks Canada. The Contractor shall coordinate and cooperate with the other users of the applicable areas.

1.7 WORK SEQUENCE

.1 Schedule work progress to allow Owner / Departmental Representative unrestricted access to inspect all phases of the Work.

.2 Maintain fire and emergency access on the roadways at all times.

.3 Co-ordinate Work with other Contractors / Departmental Representatives doing maintenance, survey / testing work.

.4 The Contractor shall prepare a meaningful bar chart or network diagram showing the proposed schedules of major work, which shall be submitted to the Departmental Representative in accordance with Section 01 32 16 - Construction Progress Schedules.

.5 The Contractor shall:

.1 Obtain the Interim Certificate (Substantial Performance) by September 30, 2021.

.2 Complete all of the Work by October 31, 2021 (Contract Completion Date).

.3 Demobilize from site if at any time, the relevant area is declared to be at risk of being impacted by an avalanche.

.4 Remobilize to site only when the relevant area is declared to not be at risk of being impacted by an avalanche.

1.8 CONTRACTOR USE OF PREMISES

.1 Contractor has unrestricted use of site subject to Section 01 14 00 –Work Restrictions and Section 01 29 01 – Site Occupancy, until Contract Completion date. The Contractor's use

of the site is not exclusive of other contractors or work zones within the limits of this Contract.

.2 Contractor shall limit use of premises for Work, for storage, and for access, to allow:

.1 Owner occupancy.

.2 Work by other Contractors.

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

.4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.5 The Contractor and any subcontractors shall obtain a business license and vehicle work passes in accordance with Section 01 35 43 - Environmental Procedures.

1.9 OWNER OCCUPANCY

.1 Owner will occupy premises during entire construction period for execution of normal operations.

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

.3 Contractor must allow access to the Work Site for other Contractors and PCA. It is up to the Contractor to plan their work accordingly.

1.10 OWNER FURNISHED ITEMS

.1 Notify the Departmental Representative immediately of any Owner supplied items which may be unfit for purpose.

.2 Seed for hydro-mulch application.

.3 Approximately 3,600m^3 of Pit Run is available at Red Rock SMS for the Contractor's use in accordance with the Contract Documents.

.4 Owner supplied Rare Plants, Contractor to install. See table below for propagation targets:

.1

Latin name	Common name	Target Quantity	Container Size	Propagule source	Estimated delivery date[1]	Delivery format
Allium geyeri var geyeri	Geyer's Onion	1142	4" pot	Plants /Seed Salvaged from site	March 31-September 30, 2021	shipped in pots or other method approved by PCA Project Authority.
Berberis repens	Oregon Grape	1483	#1 Pot	Plants Salvaged from Site	March 31-September 30, 2021	shipped in pots or other method approved by PCA Project Authority.

1 Delivery dates are estimates only, and should ultimately be determined by when the site is ready for planting. It is the responsibility of the contractor to determine the best method for salvage of material to meet the delivery dates.

Latin name	Common name	Target Quantity	Container Size	Propagule source	Estimated delivery date[1]	Delivery format
Calochortus apiculatus	Mariposa Lily	565	4" Pot	Plants Salvaged from Site	March 31-September 30, 2021	shipped in pots or other method approved by PCA Project Authority.
Osmorhiza occidentalis	Sweetroot	13	4" Pot	Plants Salvaged from Site	March 31-September 30, 2021	shipped in pots or other method approved by PCA Project Authority.
Phacelia hastata	Silverleaf Scorpion Weed	919	4" Pot	Plants Salvaged from Site	March 31-September 30, 2021	shipped in pots or other method approved by PCA Project Authority.

1.11 CONSTRUCTION SIGNAGE

.1 To be in accordance with Section 01 35 31 - Special Procedures for Traffic Control.

.2 Signage shall be coordinated with other Contractors.

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

1.12 SETTING OUT OF WORK

.1 Departmental Representative will establish control points and provide:

.1 Complete set of construction Drawings.

.2 Alignment notes showing curve data and control point coordinates.

.3 Provide a list of control monuments including coordinates and elevations on request.

.4 The Departmental Representative will not conduct Measurements for Payment (Quantity Surveys). The Contractor is responsible for supporting and justifying quantities for payment.

.2

.2 Contractor shall:

.1 Not permanently mark any infrastructure or feature during their setting out of the work. They shall fully remove any set out marks, markers, or other identifiers that they installed, prior to demobilizing from the Work Sites.

.2 Set additional control points as necessary.

.3 Set all work stakes necessary to complete work.

.4 Allow sufficient time for Departmental Representative to take measurements for payment.

.5 Not damage geodetic benchmarks or control monuments unless authorized by Departmental Representative.

.3 No separate payment for setting out work.

Part 2 Products

.1 To be in accordance with AT - Standard Specifications for Highway Construction (latest edition).

Part 3 Execution

.1 To be in accordance with AT - Standard Specifications for Highway Construction (latest edition).

END OF SECTION

01 14 00 WORK RESTRICTIONS

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.2 ACCESS AND EGRESS

.1 Provide for pedestrian, cyclist, and vehicular traffic for the duration of the construction.

.2 Construction operations shall be conducted to cause minimal inconvenience to the public and to owners of adjoining property. Existing access to property shall be maintained as far as possible and if new access must be provided, every effort shall be taken to provide the new access before the existing access is removed. Contractor will be responsible for repairing any damage incurred, at the Contractor's cost.

.3 The Contractor is responsible for the development and supply of construction access to the Work as approved by the Departmental Representative.

.4 The main access bridge to site is rated to carry full non-permit legal loading (CL1-625) truck defined in the CHBDC S6-14 at 20 km/h. Proponents may measure dimensions of the bridge by parking at the closed gate and taking measurements at that end as the cross section is essentially consistent.

1.3 USE OF THE SITE AND FACILITIES

.1 The Work Sites specified in the Contract shall only be used for the purposes of the Work.

.2 The Work Site (limits shown on the Drawings) will be specified by Parks Canada and shall only be used for the purposes of the Work. The Work Site will be made available by Parks Canada to the Contractor for its non-exclusive use for the duration of the Work, unless otherwise provided in the Contract Documents.

.1 The Contractor will be permitted to set up a worker's camp. Conditions must be met and Workers Camp Management Plan is to be submitted, in accordance with Section 01 33 00 – Submittal Procedures.

.3 Office-tool trailer may also be set up in the Campground. See Section 01 35 43 – Environmental Procedures.

.4 The Contractor shall not store material or park equipment along the road or parkway Right of Way within the clear zone.

.5 Contractor shall maintain adequate drainage at the Work Site.

.6 The Contractor shall keep the Work Site clean and free from accumulation of waste materials and rubbish regardless of source. Snow shall be removed by the Contractor as necessary and at their cost for the performance and inspection of the Work.

.7 The Contractor shall provide sanitary facilities for work force in accordance with governing regulations and Section 01 35 43 - Environmental Procedures. The Contractor shall post notices and take such precautions as required by local health authorities and keep area and premises in sanitary condition.

.8 Any damage to the Work Site caused by the Contractor shall be repaired by the Contractor at their expense.

.9 Pets shall not be brought to or maintained at the site.

1.4 WORKING TIMES

.1 Work in WLNP is permitted 24 hours per day, 7 days a week unless stipulated otherwise in the Contract Documents.

.2 The Contractor will not be permitted to work during the following special events unless prior written approval is granted by the Departmental Representative:

.1 Special Events (2021):

.2 none currently scheduled

.3 Variance of the Working Times and any others may be provided on the strict condition of satisfactory performance in all requirements as determined at the Departmental Representative's discretion and may be revoked at any time for any reason. It is provided on the presumption that no additional costs or any delay will be attributed to Parks Canada in relation to conducting Works in accordance with the Variance and if that is not the case, the Contractor shall not commence work under the Variance. No claims for additional costs, delays, schedule impacts, loss of productivity or other extra Works resulting from a Variance will be entertained.

1.5 WORK CONDUCTED OVER OR ADJACENT TO WATERWAYS

.1 All components of the Work shall be conducted in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project.

.2 All components of the Work shall be conducted without equipment entering into wetlands, water bodies, or streams.

.3 All waste materials from the Work shall be contained and collected in a manner to prevent any contact with the river valleys and waterways. All collected waste materials shall be disposed of in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the Project.

1.6 UTILITIES

.1 The Contractor shall become familiar with all utilities and services adjacent to the Work and shall be responsible for cost of repair of any damage resulting from their operations.

.2 The Contractor shall establish and maintain direct and continuous contact with the owners or operators of any Utilities which may interfere with the Work. The Contractor shall co-operate with them at all times and in all places of Work. The Contractor shall keep the Departmental Representative informed of all communications with the Utility companies and authorities.

.3 The Contractor shall notify the Departmental Representative and the Utility companies at least seven (7) days in advance of any activities which may interfere with the operation of such Utilities.

.4 Whenever working in the vicinity of Utilities, the Contractor shall locate such Utilities and expose those that may be affected by the Work, using hand labour as required.

.5 The Contractor shall assess the possible impact of its operations on all Utilities that may be affected by its operations, and shall, in consultation with Utility owner(s), protect, divert, temporarily support or relocate, or otherwise appropriately treat such Utilities to ensure that they are preserved.

.6 The Contractor shall immediately report any damage to Utilities to the Departmental Representative and to the Utility company or authority affected and shall promptly undertake such remedial measures as are necessary at no additional cost to the Owner.

1.7 SURVEY OF EXISTING CONDITIONS

.1 Submission of tender is deemed to be confirmation that the Contractor has inspected the Site and is conversant with all conditions affecting execution and completion of work.

.2 The Contractor shall perform an initial site survey, prior to commencing work, in accordance with Section 01 71 00 – Examination and Preparation.

.3 The Contractor shall regularly monitor the condition of the Work Site and of property on and adjoining the Work Site throughout the construction period and shall immediately notify the Owner if any deterioration in condition is detected. Such monitoring shall cover all pertinent features and property including, but not limited to, buildings, structures, roads, walls, fences, slopes, sewers, culverts and landscaped areas.

.4 The Departmental Representative may, but shall not be obligated to, survey and record the condition of the Work Site and of property on or adjoining the Work Site prior to the commencement of construction by the Contractor. If requested and available, the Departmental Representative will provide a copy of the survey records to the Contractor for reference.

.5 Whenever supplied with survey records, the Contractor shall satisfy itself as to the accuracy and completeness of the survey records provided by the Departmental Representative for any area before commencing construction in that area.

.6 Commencement of construction in any area shall be interpreted to signify that the Contractor has accepted such survey records as being a true record of the existing conditions prior to construction.

.7 The provision of the records of a survey of existing conditions by the Departmental Representative shall in no way limit or restrict the Contractor's responsibility to exercise proper care to prevent damage to all property within or adjacent to the Work Site, whether all such property is covered by the survey or not.

1.8 ARCHAEOLOGICAL RESOURCES

.1 As identified in Crandell Mountain Campground Reconstruction – Construction Environmental Management Plan – March 5, 2020 (CEMP).

1.9 INSTREAM WORK

.1 Not allowed.

1.10 PROTECTION OF PERSONS AND PROPERTY

.1 The Contractor shall comply with all applicable safety regulations of WorkSafe AB and the Workers Compensation Act of British Columbia and Alberta including, but not limited to, Occupational Health and Safety Regulations and General Safety Regulations. Within the Site, the Contractor has all the responsibilities of an "employer" under the *Workers Compensation Act* and the *Occupational Health and Safety Regulation* and is designated as the "Prime Contractor".

.2 Prime Contractor must comply with Workers Compensation Act and Occupational Health and Safety Regulation Section 20.3 Coordination of multiple employer workplaces.

.3 Comply with all applicable safety regulations of the Workers' Compensation Board of British Columbia and Alberta (WCB) including, but not limited to, WCB's Industrial Health and Safety Regulations, Industrial First Aid Regulations, and Workplace Hazardous Materials Information System Regulations, when working in that province.

.4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

.5 The Contractor shall take all necessary precautions and measures to prevent injury or damage to persons and property on or near the Work Site.

.6 The Contractor shall promptly take such measures as are required to repair, replace or compensate for any loss or damage caused by the Contractor to any property or, if Parks Canada so directs, shall promptly reimburse to Parks Canada the costs resulting from such loss or damage.

1.11 USE OF PUBLIC AREAS

.1 Off-road construction equipment will not be allowed on the existing highway except at designated areas where the existing highway is scheduled for re-construction in this Contract, material loading areas, or alternate sites as designated and approved by the Departmental Representative.

.2 Steel tracked equipment with cleats will not be allowed on pavement designated for future use. If or when crossing asphalt designated for future use, rubber mats must be used under the tracks to protect the asphalt. Asphalt, granular, embankment and excavation materials may be hauled on existing highway but this shall be by standard highway trucks not exceeding legal highway load limits unless accepted in writing by the Departmental Representative.

.3 Flag persons shall be provided when vehicles are entering or exiting Work Site access points and when vehicles are entering or exiting gravel pits in the park. Pit access gates must remain closed at all times or have a gate person monitoring the opening for wildlife.

.4 The Contractor shall ensure that its vehicles and equipment do not cause nuisance in public areas. All vehicles and equipment leaving the Work Site and entering public roadways shall be cleaned of mud and dirt clinging to the body and wheels of the vehicle. All vehicles arriving at or leaving the Work Site and transporting materials shall be loaded in a manner that will prevent dropping of materials or debris on the roadways and, where contents may otherwise be blown off during transit, such loads shall be covered by tarpaulins or other suitable covers. Spills of materials in public areas shall be removed or cleaned immediately by the Contractor at no cost to the Owner. All activities shall be in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project.

.5 Construction areas and construction crossings shall be flood-lit for night operations.

1.12 USE OF PITS AND QUARRIES

.1 No storage, staging, excavation or extraction is allowed in pits and staging areas listed under this Contract.

.2 When the Contractor is operating in a PCA pit or quarry, the Contractor shall utilize the pit or quarry in accordance with the Departmental Representative's authorization. Under no circumstances will waste of useable material be permitted.

.3 Expansion of working pits is not authorized unless written approval has been given from the Departmental Representative. The Contractor shall confine all work in the pit within the limits of the existing cleared area.

.4 The Contractor shall be responsible for managing their working space within the pit(s) and quarries and coordination with Parks Canada contractors, personnel or others, to maintain access.

.5 Any claims by the Contractor or its subcontractors arising from the quality and quantity of material available, condition of, access and working space within the available pits and quarries will not be entertained, even if those claims are associated with the activities of Contractors or works conducted for Parks Canada Agency.

.6 No separate payment will be made for clearing, grubbing, disposal or relocation of stockpiles, debris or contaminated materials, or for any other costs of site preparation, pit development, pit maintenance and final cleanup, or access, or for any delay or other cost arising from, the suitability of the referenced PCA pit, or the use of referenced PCA pits by others, and all costs thereof shall be covered in the prices for the Items under which payment is provided for the applicable materials.

.7 No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

.8 Pit work must be carried out in accordance with the local provincial government Health, Safety and Reclamation requirements, the current Standard Specifications for Highway Construction and Best Management Practices for the area the Work is occurring in.

1.13 USE OF PITS, QUARRIES, AND DISPOSAL SITES, OUTSIDE OF THE NATIONAL PARKS

.1 When the Contractor is supplying material from a pit or quarry outside of the National Parks the Contractor is responsible for all permits and approvals. Pit or quarry development and reclamation must be in accordance with local and Provincial regulatory agency requirements.

.2 When the Contractor is disposing of; stripping, waste, or surplus material in a pit or other disposal sites outside of the National Parks the Contractor is responsible for all permits and approvals. Disposal site or pit development and reclamation must be in accordance with local and Provincial regulatory agency requirements.

.3 The Contractor shall bear and pay all costs, fees, and royalties for pits, quarries, or disposal sites, outside of the National Parks.

.4 Material supplied from pits and quarries outside of the National Parks must be clean of all, seeds, organics, topsoil, or contaminants. No additional payment will be made for cleaning or washing material supplied from pits and quarries outside of the National Parks.

.5 Material supplied from pits and quarries outside of the National Parks must meet requirements in the Contract Documents.

.6 Pit excavation must not take place to within a minimum distance of 2m from the edge of cleared and stripped areas.

.7 All working pit faces, and stockpiles must be trimmed to 1.5H to 1V slope. Working pit faces must be reshaped with native granular materials. All other permanent slopes must be re-sloped to no steeper than 2H to 1V.

.8 No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

.9 Pit work must be carried out in accordance with the local provincial government Health, Safety and Reclamation requirements, the current Standard Specifications for Highway Construction and Best Management Practices for the area the Work is occurring in.

1.14 SUPERVISORY PERSONNEL

.1 When requesting a Preconstruction Meeting, in accordance with Section 01 31 00 -Project Management and Coordination, the Contractor shall submit to the Departmental Representative confirmation of the names of the supervisory personnel and other key staff designated for assignment on the Contract.

.2 At a minimum, the following personnel shall be included in the list:

.1 Contractor Manager

.2 Project Superintendent;

.3 Safety Representative;

.4 Quality Control Manager;

.5 Environmental Representative;

1.15 THE ABOVE PERSONNEL SHALL PERFORM THE FOLLOWING DUTIES:

.1 Contractor Manager with full authority, as agent of the Contractor, to act on behalf of and legally bind the Contractor in connection with the Work and the Contract. The Contractor may, at its discretion, appoint one person as both Contractor Manager and Project Superintendent.

.2 The Project Superintendent shall be employed full time with full authority to supervise the Work, who shall be directly available to the Department Representative during all active periods of Work. Either they or their designated deputy shall be present on the Work Site each and every workday that Work is being performed, from the commencement of Work to Total Performance of the Work. Project Superintendent and their designated Deputy must have a minimum of 5 years experience in the type of works being performed. Project Superintendent and their designated Deputy are responsible for supervising all their subcontractors and ensuring each subcontractor has their own foreman onsite during all works.

.3 The Project Superintendent shall nominate a Deputy Project Superintendent who shall have the authority of the Project Superintendent during the latter's absence. Deputy Project Superintendent must have a minimum of 5 years experience in the type of works being performed.

.4 The Safety Representative shall possess a minimum of 2 years' construction safety supervisory experience. Their duties shall encompass all matters of safety activities from commencement of Work until the Total Performance of the Work.

.5 The Quality Control Representative shall be responsible for the development, implementation and execution of the Quality Management Plan and shall be the single point of contact for all quality related queries.

.6 The Environmental Representative shall be responsible for the development, implementation and execution of the Environmental Protection Plan and shall be the single point of contact for all environmental related queries.

1.16 WASTE MANAGEMENT AND DISPOSAL

.1 All surplus, unsuitable and waste materials shall be removed from the Work Sites to approved sites outside the National Parks. Refer to Section 01 35 43 - Environmental Procedures.

.2 Deposit of any construction debris into any waterway is strictly forbidden.

.3 Cost for Waste management and disposal described above shall be considered incidental to the Unit Price items and no additional payment will be made.

1.17 WORK STOPPAGE

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

1.18 WINTER SHUTDOWN

.1 If the Work is scheduled to span over winter months, the Contractor shall prepare the Site for safe, efficient winter operations and the travelling public. Winter shutdown requirements include, but are not limited to, Erosion and Sediment Controls, relocation or installation of barriers, re-instatement of damaged pavement, line painting, traffic signage, and re-instatement of existing highway speed limits for winter shutdown.

.2 The Contractor shall arrange a meeting with the Departmental Representative in mid-September, or as weather dictates, to review winter shutdown requirements.

.3 All winter shutdown requirements shall be made to the satisfaction of the Departmental Representative, and no additional payment will be made.

1.19 AVALANCHE HAZARDS

.1 The Contractor is to adhere to the Waterton Workplace Avalanche Safety Plan and all contractors working in Crandell Mountain Campground must attend avalanche orientation training in Waterton Lakes National Park.

.2 The Contractor must not perform work in the designated hazard zone (100-year runout) of the CR2 and CR3 avalanche paths between November 1 and May 15.

.1 Between November 1 and May 15 check-in with the WLNP Avalanche Forecaster and abiding by any restrictions is mandatory.

.3 PCA will provide orientation training to all contractors and will provide avalanche safety forecasts for the Red Rock Parkway and Crandell Mountain Campground.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 21 00 ALLOWANCES

Part 1 General

1.1 REFERENCES

.1 General Conditions.

1.2 PRIME COST SUM

.1 Prime Cost Sum will only be utilized for the installation of Natural Play Areas as directed by the Departmental Representative;

.1 Included in Contract Price a total Prime Cost Sum of:

.1 **$265,000** for items as listed below.

.2 Do not include in the Contract Price, additional contingency allowances for products, installation, overhead or profit.

.3 Prime Cost Sum provided for in the Lump Sum Arrangement Table is not a sum due to the Contractor. Rather, payment will be made against it for not included in the unit price table under the General Conditions of the Contract.

.4 No interpretation of the items listed under Prime Cost Sum Allowances shall indicate that work will be included under the Prime Cost Sum. Items, tasks, and activities included in the Works elsewhere in the Contract, including Unit Price and Lump Sum Items, shall be paid as indicated in those sections and not under the Prime Cost Sum.

.5 Any and all additional work must be approved in writing by the Departmental Representative prior to commencement.

.6 All expenditures must be substantiated with verified invoices and/or accepted daily extra work reports as noted in Measurement and Payment Procedures below.

.7 The Contract Price, and not Prime Cost Sum, includes Contractor's overhead and profit in connection with the Work.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Payment for Work under **"Prime Cost Sum – Natural Play Areas"** is to be made using negotiated rates or by material, labour and equipment rates as per the following:

.1 Rental rates will be in accordance with current Alberta Roadbuilders & Heavy Construction Association's rate schedule and will be all inclusive and fully operated.

.2 Vehicles (i.e.. Pickup trucks) will be paid either at daily rates as per the Alberta Roadbuilders & Heavy Construction Association's (most recent) or by mileage using National Joint Council (NJC) rates, whichever is lower. The Contractor will not be permitted to claim both daily rental and mileage rates.

.3 Hourly rental of equipment will be measured in actual working time and necessary travel time within project limits. Transportation time to and

from site to be reimbursed only if equipment is used exclusively for additional work.

.4 Equipment paid on standby will be paid on 50% of the relevant Less Operator rates to a maximum of 10 hours per day.

.5 When based upon actual costs for additional works under Prime Cost Sum, payment will be based upon supplied invoices and other work records.

.6 The Prime Contractor may apply a 10% mark-up to subcontractor or supplier invoices only, as accepted by the Departmental Representative. No mark-up will be allowed on relevant equipment and labour rates.

.7 A claim for additional payment will be considered submitted when all required documentation has been received by the Departmental Representative.

.8 The Departmental Representative's, or their delegate's, signature on extra work reports is only a record of the equipment, materials and labour hours utilized on the task, not an agreement to entitlement or quantification of that Work. Review and acceptance may be based on Contractor submitted finalized extra work reports, which are to include appropriate rates, quantities and applicable invoices. Labour and equipment rates are to be reviewed by the Departmental Representative against the appropriate accepted rates when submitted for payment.

.9 The Contractor shall submit extra work reports to the Departmental Representative within 24 hours of the day of extra work.

.2 Extra work reports not submitted within the specified timelines may be denied payment at the Departmental Representative's sole discretion.

.3 The Departmental Representative's, or their delegate's, signature on any of the Contractor's Daily Extra Work Reports shall not be an agreement to waiver any portion of the Contract regardless of any wording to the contrary.

.4 Unless otherwise provided for in the Contract, payment on a time and materials basis represents complete payment (exclusive of GST) and reimbursement for all impacts, related costs and expenses, including, without limitation: time; labour; materials; equipment; mobilization; subcontracting; overhead; profit; general supervision; occupational tax and any other Federal or Provincial revenue legislation exclusive of GST; premiums for public liability and property damage insurance policies; bonding; for the use of all tools and equipment for which no specific rental payment provision exists; and for all costs incurred by the Contractor in supplying materials.

.5 Reimbursement for Living Out Allowance (LOA), as agreed upon by the Departmental Representative, shall be pro-rated based on the portion of the standard 10-hour workday spent on extra work items up to a maximum of 10 hours. LOA reimbursement will only be considered for extra works completed under Force Account rates and payment for LOA will not exceed the agreed upon daily rate.

Part 2 Products

.1 Products shall be in accordance with AT - Standard Specifications for Highway Construction (latest edition) or as directed by the Departmental Representative.

Part 3 Execution

.1 Work shall be in accordance with AT - Standard Specifications for Highway Construction (latest edition) or as directed by the Departmental Representative.

END OF SECTION

01 25 20 MOBILIZATION AND DEMOBILIZATION

Part 1 General

1.1 DESCRIPTION

.1 Mobilization and Demobilization consists of preparatory work and operations including but not limited to, those necessary for the movement of personnel, equipment, camp, buildings, shops, offices, supplies and incidentals to and from the project sites.

.2 Any protective measures or movement of Contractor trailers necessitated by animal interactions and required by Parks Canada will be paid by the Departmental Representative and are not to be anticipated in the Lump Sum Contract Price for Mobilization and Demobilization.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 Mobilization and Demobilization:

.1 Payment will be made under "**Mobilization / Demobilization**".

.2 50% of Lump Sum Contract Price for Mobilization and Demobilization to be paid when mobilization to site is complete.

.3 The remainder of the Lump Sum Price for Mobilization and Demobilization to be paid when work is complete, and all materials, equipment, camp, buildings, shops, offices, and other facilities have been removed from site and site cleaned and left in condition to the satisfaction of the Departmental Representative and all other Agencies having Jurisdiction.

.4 Payment of only **5%** of the total price tendered will be scheduled as outlined above. If the amount bid for mobilization and demobilization is greater than **5%** of the total price tendered, payment of the remainder of the amount will be authorized when the Contract has been completed.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 29 00 PAYMENT PROCEDURES

Part 1 General

1.1 GENERAL

.1 Payments will be made on the basis of the unit prices and lump sum prices bid in the Tender. Additions and credit to the Work will be assessed based on the prices provided

.2 Each unit or lump sum price stated on the Bid Form shall constitute full compensation as herein specified for each item of Work completed in accordance with the Drawings and Specifications. The Contractor shall be aware that if any cost item is not specifically included as a pay item on the bid form, the onus shall be on the Contractor to ensure that all project costs are built into the unit price and lump sum pay items on the bid form.

.3 Unit and lump sum prices bid shall be full and complete compensation for all work on the project. Payment will be made for only those unit price and lump sum items listed on the bid forms. All other costs that the Contractor may occur throughout the project shall be built into the unit price and lump sums bid including profit, management, administration, safety, permit and all other general costs which for this project will be considered incidental to the work.

.4 There will be no payment for materials onsite that have not been incorporated into the Works.

.5 Other materials on site, whether existing structures, vegetation, topsoil, gravel, sand or other excavated or piled materials, are the property of the Departmental Representative or of the Department of the land on which the Work is located. Only those materials specifically noted in these specifications as belonging to the Contractor shall become the Contractor's property.

.6 Any item of the work not called for in the specifications or shown on the drawings but clearly required to meet the intent of design and normally provided for the proper operation of the work shall be provided as if specifically called for in these specifications. No additional payment will be made for this incidental work.

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Make applications for payment on account as provided in Agreement as Work progresses.

.2 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.

.3 Submit to Departmental Representative, at least 21 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.

.4 Payment may be withheld for Works that the Contractor does not demonstrate, through documentation, is within conformance with the technical and contractual requirements until such a time as documentation confirming compliance is provided to the Departmental Representative.

.5 Applications for Progress Payment shall not be considered received until all required documentation has been received by the Departmental Representative.

1.3 SCHEDULE OF VALUES FOR LUMP SUM ITEMS

.1 The Contractor shall provide Schedule of Values for each Lump Sum item to provide a breakdown of the Sum in enough detail to facilitate continued evaluation of the progress of the work included at the time of bidding. Schedule of Values will be used as the basis for reviewing applications for payment of the lump sum items in terms of validation of Progress Payments. The breakdown of the value of any lump sum item will be subject to the approval of the Departmental Representative, who may require the Contractor to provide additional information to validate the breakdown prior to approval.

.2 Should the Departmental Representative determine that any component within the Schedule of Values does require justification to demonstrate the reasonableness of the amount, the Contractor shall provide further information to substantiate and justify or revise the amounts to the satisfaction of the Departmental Representative.

1.4 PROGRESS PAYMENT SUPPORTING DOCUMENTATION REQUIREMENTS

.1 In addition to other noted requirements, the Contractor shall provide the following supporting documentation for all applications for progress payment.

.2 Written Quality Compliance Certificate:

.1 All items of work included for progress payment shall be accompanied by supporting quality documentation under a cover page that demonstrates the entirety of the claimed work is in conformance with the quality requirements. Items anticipated to be included are, among other things, material certificates, testing results, inspection reports, survey reports etc.

.2 Each application for progress payment shall include a written certificate that conforms all works being claimed are in conformance with all quality requirements. The certificate shall be on the Contractor's letterhead and authorized by the Contractor's Quality Manager.

.3 Written Quantity Calculations:

.1 All items of work included for progress payment shall be accompanied by supporting quantity calculations under cover page. The calculations shall be presented in such a way as to allow independent verification of all steps required to reach the claimed quantity and be supported by all necessary inputs to allow the calculation to be repeated. Supporting documentation anticipated to be included are, among other things, survey reports, survey data and related surfaces, scans / markups of manual take-offs, photos, excel tabulations etc.

.4 Project Schedule Reporting:

.1 Per Section 01 32 16 Clause 1.6, the Contractor shall provide an updated Project Schedule that accurately represents the status of all items of work and compares that status to the baseline status as recorded in the accepted Master Schedule or baseline schedule on a single Gantt chart.

.2 Each application for progress payment shall include a written narrative identifying Work status to date, comparing current progress to accepted Master Schedule or baseline schedule, presents current forecasts, identifies areas of concern, anticipated delays, and associated mitigation strategies. The narrative shall be on the Contractor's letterhead and authorized by the Contractor's Project Manager.

END OF SECTION

01 29 01 SITE OCCUPANCY

Part 1 General

1.1 DEFINITION OF OCCUPANCY

.1 The Contractor shall be permitted to lease and occupy sites where they will be working in the National Parks, free of charge from the date of award of the Contract up to and including the specified completion date. The sites to be leased by the Contractor include all the roads and areas specified in the Contract Documents and as directed by the Departmental Representative.

.2 The Contractor's occupancy of the sites identified in Contract will be deemed to have ended, when the following conditions are met to the satisfaction of Parks Canada:

.1 All the work identified under this Contract, has been completed.

.2 Any outstanding deficiencies for the work identified under this Contract have been addressed to the satisfaction of the Departmental Representative.

.3 Contractor has removed from the park all trailers and equipment and sites have been cleaned-up to the satisfaction of the Departmental Representative.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 31 00 PROJECT MANAGEMENT AND COORDINATION

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This Work shall be incidental to the Contract and will not be measured for payment.

1.2 CHANGES TO DESIGN

.1 If a change from the IFC design is accepted in writing by the Departmental Representative and agreed on by the Contractor, a design variance letter will be issued by the Departmental Representative. The design variance letter must state what changes are being made from the IFC design and what the method of measurement for payment will be, if varying from the Contract Documents.

.2 The design variance letter must be signed by both the Contractor's Representative and the Departmental Representative prior to performing the Work.

.3 The Departmental Representative reserves the right to use as-built survey or neat line measurements for payment if for any reason tolerances are not in accordance with the IFC design.

1.3 COORDINATION

.1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other Contractors, and Work by Owner, under instructions of the Departmental Representative.

1.4 PROJECT MEETINGS

.1 During the course of the Work, the Contractor shall attend weekly construction meetings as scheduled, chaired, and documented by the Departmental Representative.

.2 The agenda will include among other things, general construction, payment, scheduling, risk, quality, environmental, and safety management items as well as any other reasonably requested by the parties.

.3 The Contractor shall provide physical space and make arrangements for meetings at or near the Work Sites for all meetings that take place in relation to the Contract from their mobilization until their demobilization.

.4 Meetings held outside of the time noted above (before mobilization or after demobilization) will either be held in the local PCA Field Unit offices, or at the Owner's site office, as notified by the Departmental Representative.

.5 The Contractor will attend or otherwise ensure the attendance of their staff, subcontractors, consultants, suppliers, or other key parties all other meetings identified in the Contract or reasonably requested by the Departmental Representative in an effort to resolve specific issues as they may arise.

.6 Meetings will be called and chaired by the Departmental Representative as required. The Contractor shall be represented at such meetings to the satisfaction of the Departmental Representative.

.7 As described in Section 01 35 43 – Environmental Procedures, an environmental briefing for all staff will take place before beginning work at the site.

1.5 CONSTRUCTION ORGANIZATION AND START-UP

.1 Within seven (7) days after award of Contract, request a Preconstruction meeting of Contract Representatives to discuss and resolve administrative procedures and responsibilities. Meeting shall be chaired by the Departmental Representative who will prepare the minutes of the meeting.

.2 Senior representatives of the Owner, Departmental Representative, Contractor, major subcontractors, field inspectors and supervisors are to be in attendance.

.3 Agenda to include following:

.1 Appointment of official representative of participants in Work.

.2 Schedule of Work, progress scheduling in accordance with Section 01 32 16 – Construction Progress Schedules.

.3 Schedule of submittals in accordance with Section 01 33 00 – Submittal Procedures.

.4 Requirements for temporary facilities, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 – Construction Facilities.

.5 Site safety and security in accordance with Sections 01 14 00 – Work Restrictions, 01 35 29 – Health and Safety Requirements, 01 52 00 – Construction Facilities and 01 35 43 – Environmental Procedures.

.6 Quality Control in accordance with Section 01 45 00 – Quality Control.

.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.

.8 Owner-furnished materials.

.9 Monthly progress claims, administrative procedures, photographs, and holdbacks.

.10 Closeout procedures and submittals in accordance with Sections 01 77 00 – Closeout Procedures and 01 78 00 – Closeout Submittals.

.11 Insurances and transcript of policies.

.12 Other business.

.4 Comply with Departmental Representative's allocation of mobilization areas of site, for field offices and sheds, and for access, traffic, and parking facilities.

.5 During construction, coordinate use of site and facilities through Departmental Representative's procedures for intra-project communications: submittals, reports and records, schedules, coordination of Drawings, recommendations, and resolution of ambiguities and conflicts.

.6 Comply with instructions of the Departmental Representative for use of temporary utilities and construction facilities.

.7 Coordinate field engineering and layout work with the Departmental Representative.

1.6 ON-SITE DOCUMENTS

.1 Maintain at job site, one copy each of the following:

.1 Contract Drawings if part of tender

.2 Specifications

.3 Addenda

.4 Reviewed Shop Drawings and mix designs

.5 Change Orders
.6 Other modifications to Contract
.7 Traffic Management Plan
.8 Safety Plan
.9 WHMIS
.10 Environmental Protection Plan
.11 Quality Control Plan and field test reports
.12 Copy of accepted Work schedule and most recent updated schedule
.13 Labour conditions and wage schedules
.14 Equipment rate schedule and applicable versions of the relevant rate guides
.15 Applicable current editions of municipal regulations and by-laws

1.7 PROJECT SCHEDULES

.1 In accordance with Section 01 32 16 - Construction Progress Schedules.

1.8 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
.2 Submit requests for payment for review, and for transmittal to Departmental Representative. Payment request on last day of the month.
.3 Submit requests for interpretation of Contract Documents and obtain instructions through Departmental Representative.
.4 Process substitutions through Departmental Representative.
.5 Process change orders through Departmental Representative.
.6 Submittal Schedule:
.1 Prepare a schedule of the required submissions and the date the submissions will be made. Include columns for Actual Date of Submission, Review Comments Received, Final Submission and Final Acceptance Received. Provide this schedule to the Departmental Representative in Excel format.
.2 The Owner will not be responsible for any construction delays resulting from delays in submission acceptance if the submittal dates shown in the Submittal Schedule are not achieved.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 32 16 CONSTRUCTION PROGRESS SCHEDULES

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This Work shall be incidental to the Contract and will not be measured for payment.

1.2 DEFINITIONS

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

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

.3 Baseline: Original accepted plan for Project.

.4 Construction Work Week: Monday to Saturday, inclusive, will provide six-day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: Number of work periods (not including holidays or other nonworking periods required to complete an activity or other Project element. Usually expressed as workdays or work weeks.

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

.7 Milestone: A significant event in Project, usually completion of a major deliverable.

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

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

1.3 REQUIREMENTS

.1 Ensure the Project Schedule is practical and remains within specified Contract duration.

.2 Ensure all the Work required for the Contract is identified in the Project Schedule. Refer to Section 01 11 00 – Summary of Work for a potential list of activities.

.3 Include an allowance in the schedule for Work performed and paid for as Prime Cost Sum. Refer to Section 01 21 00 – Allowances for a list of potential activities.

.4 Include the requirements of Section 01 14 00 – Work Restrictions and Section 01 35 43 – Environmental Procedures.

.5 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this Contract.

.6 After review, revise and resubmit schedule to comply with revised project schedule.

.7 During progress of Work revise and resubmit as directed by the Departmental Representative. If schedule is requested and not received, the Departmental Representative may hold back progress payment until an updated Project Schedule is received and accepted.

1.4 SUBMITTALS

.1 In accordance with Section 01 33 00 – Submittals Procedures.

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

1.5 PROJECT MILESTONES

.1 Project milestones form interim targets for Project Schedule.

.2 Include in Project Schedule the Contractual dates under Section 01 11 00 - Summary of Work.

1.6 MASTER PLAN

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

.2 Revise Departmental Representative reviewed impractical schedule and resubmit within 5 working days.

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

1.7 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule separately identifies the Work by area and station.

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

.1 Contract Award

.2 Obtaining Permits

.3 Pre-mobilization Submittals

.4 Mobilization

.5 Grubbing

.6 Stripping

.7 Pavement removal

.8 Common excavation

.9 Underground servicing installation incl. sanitary, storm, water.

.10 Cast-in-Place Concrete

.11 Gravel Fill and Granular Base Course production, installation and finishing

.12 Culvert works

.13 Septic Fields
.14 Water treatment plant
.15 Manholes, drywells, water and wastewater storage tanks
.16 Water and sanitary mains and services
.17 Water supply well works
.18 Electrical works
.19 Landscaping, seeding, planting and associated works
.20 Site reclamation and rehabilitation
.21 Interim Inspection
.22 Remediation of any noted deficiencies
.23 Site Clean-up / Demobilization
.24 Final Completion

1.8 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on monthly basis or as and when requested by the Departmental Representative, reflecting activity changes and completions, as well as activities in progress.

.2 Provide Weekly Progress Reports that identify completed work and Work planned for the following week in accordance with Section 01 33 00 - Submittal Procedures.

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

1.9 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage.

.1 Activities considered behind schedule are those with projected start or completion dates later than current accepted dates shown on baseline schedule.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 33 00 SUBMITTAL PROCEDURES

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.2 ADMINISTRATIVE

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

.2 Do not proceed with Work affected by submittal until review is complete, and written acceptance of the submittal has been issued by the Departmental Representative.

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

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

.5 Submittals must be accompanied by a completed Quality Control Checksheet in accordance with Section 01 45 00 – Quality Control prior to submission to Departmental Representative. This completed Quality Control Checksheet represents that all the necessary requirements have been met and that the 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 shall be considered rejected.

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

.7 Verify field measurements and affected adjacent Work is consistent.

.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 accepted copy of each submission on site.

1.3 "DESIGN AND BUILD", SHOP DRAWINGS, PRODUCT DATA, AND MIX DESIGNS

.1 "Design and Build": The term "Design" refers to all detailed design activities (survey, investigation, drawings, specifications) based on general requirements contained in the Contract Documents. "Build" refers to construction of Contractor's detailed design after design has been reviewed by the Departmental Representative. Contractor's responsibility for error and omissions in submission is not relieved by Departmental Representative's review of submittals.

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

.3 The term "Mix Design" means an engineered design for proportioning materials in concrete or asphalt concrete pavement including all supporting test results, materials

properties, that is acceptable to the Departmental Representative. **Asphalt mix design to be performed by a qualified member of the Association of Professional Engineers and Geoscientist who is licenced to practice in Alberta, or by a qualified technician registered in Alberta who has CCIL Asphalt Certification.**

.4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of section under which adjacent items will be supplied and installed. Indicate cross-references to Contract Documents.

.5 Allow fourteen (14) calendar days for Departmental Representative's review of each submission.

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

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

.8 Submit letter(s) of certification with all mix designs.

.9 Accompany submissions with a transmittal letter containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, mix design, product and sample.
- .5 Other pertinent data.

.10 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 the Contract Documents.
- .5 Details of appropriate portions of the Work as applicable:
  - .1 Fabrication,
  - .2 Performance characteristics,
  - .3 Standards.

.11 After the Departmental Representative's review, distribute copies.

.12 Submit one (1) electronic copy of the shop drawings or mix design for each requirement requested in the Contract Documents and as requested by the Departmental Representative.

.13 Submit one (1) electronic copy of the product data sheets or brochures for requirements requested in the Contract Documents and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of the product.

.14 Delete information not applicable to project.

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

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

.17 The review of shop drawings and mix designs by Departmental Representative is for the sole purpose of ascertaining conformance with the Contract requirements. This review shall not mean that Departmental Representative approves details of the design inherent in shop drawings, responsibility for that shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents. Without restricting the generality of the foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

1.4 SAMPLES

.1 Material samples to be provided as outlined in the Contract Documents or as requested by the Departmental Representative.

1.5 MOCK-UPS

.1 Not used.

1.6 CERTIFICATES AND TRANSCRIPTS

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

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

1.7 REQUIRED CONTRACTOR SUBMITTALS

.1 General

.1 This Clause identifies the plans, programs, and documentation required prior to mobilization on site and during the construction phase.

.2 Pre-Mobilization Submittals: The Contractor shall not begin any site Work until the Departmental Representative has authorized acceptance of submittals in writing. Submit the following plans and programs to the Departmental Representative for review a minimum of fourteen (14) calendar days prior to mobilization to the project site:

.3 Project schedule, detailing the schedule of the workdays required from Contractor, subcontractors, suppliers and consultants to complete each activity of the project by location in order to meet stages specified in Section 01 32 16 – Construction Progress Schedules. In addition, for each activity critical elements

that could impact on the schedule are to be identified. Submission shall include both a paper copy of the schedule and an electronic copy in Microsoft Projects format.

.4 Environmental Protection Plan (EPP) that meets the requirements of Section 01 35 43 – Environmental Procedures. Submission of EPP must allow 2 weeks for review by the Parks ESO, in accordance with Section 01 35 43 – Environmental Procedures.

.5 Plan describing methods the Contractor will have to meet their responsibilities as the Prime Contractor for Safety and Traffic Control within the Work limits and to co-ordinate Work, traffic control, site access, safety, with other Contractors working in or adjacent to the Contract Work zone.

.6 Health and Safety Plan - The Contractor shall have a Certificate of Recognition (COR) or Registered Safety Plan (RSP) including a site-specific Health and Safety Plan acceptable to the Departmental Representative. The Contractor shall implement and maintain the Health and Safety Plan during the Work. 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. Health and Safety Plan must include in accordance with Section 01 35 29 – Health and Safety Requirements.

.1 Contractor shall develop an “Emergency Procedures Protocol” in consultation with Parks Canada. On site Contingency and Emergency Response Plan to address standard operating procedures to be implemented during emergency situations. Emergency Response Plan can be incorporated into the Health and Safety Plan.

.7 Traffic Management Plan, in accordance with the requirements of Section 01 35 31 – Special Procedures for Traffic Control.

.8 Quality Control Plan in accordance with Section 01 45 00 – Quality Control, including Quality Control checklist examples for each item of Work.

.9 Alberta One Call and Utilities Coordination Plan, including notifications to Utility Owners.

.10 Contractor and any subcontractors to submit a copy of their valid Parks Canada Business License.

.11 Contractor Chain of Command, listing key Contractor personnel, including for each name, position, qualification, experience, telephone and cellular telephone. The list shall include the names and telephone / cellular telephone for contact persons who are available on a 24-hour basis in the event of emergencies.

.12 List of subcontractors, suppliers and consultants, their role and their key personnel, including names and positions, addresses, telephone and cellular telephone.

.13 Work Plan, describing in detail for each activity by location, the Contractor’s intended methods of construction, and materials, equipment and manpower that will be used to meet stages specified in Section 01 32 16 – Construction Progress Schedules. The Work Plan must be linked to the Project Schedule.

.14 Schedule of Force Account rates, in accordance with Section 01 21 00 – Allowances.

.15 Survey Plan describing the Contractor's intended methods of surveying during this project and applicable resumes in accordance with Section 01 71 00 – Examination and Preparation.

.16 Pit sourcing information and testing results (i.e. Micro-Deval Test).

.17 Workers Camp Management Plan must describe the Contractor's responsibilities and mitigations for the workers camp. The Plan must include:

.1 Wildlife concerns regarding food, cooking and garbage/waste.

.2 Security of wildlife attractants (privies, waste, cookware).

.3 Quiet times, including generator noise.

.4 Camp location, which must be within the limits of disturbance for construction and not within an avalanche path.

.5 Washroom, kitchen/cooking and eating facilities.

.6 No open fires.

.7 All waste water generated at the camp must be self contained. Waste water is not permitted to be released into the natural environment.

.8 Gate to the campground must be locked outside of construction work hours to avoid trespass by others. Camp security will be the responsibility of the Contractor.

.9 Camp waste, and only camp waste, must be stored in the haul-all bin provided by PCA. Waste in the bin will be collected by PCA.

.10 Only contractors and subcontractors actively working at the site are permitted to stay at the camp overnight.

.11 All camp occupants will be required to attend a wildlife safety briefing.

.12 PCA reserves the right to revoke permission to camp at any time for any reason. PCA will not be responsible for cost incurred by the Contractor if camp permission is revoked.

.18 The Contractor shall not begin any Work on the Site until the Departmental Representative has provided a Notice to Proceed.

.2 Construction Phase Submittals

.1 Monthly Progress Reports in accordance with Section 01 32 16 – Construction Progress Schedules.

.2 Weekly Progress Reports that outline the detailed Work (Contractor, subcontractors, suppliers, consultants) completed to date as well as the anticipated Work to be performed for the following week on a day-by-day basis. Work to be linked to activities by location identified in project schedule and to provide information on materials, equipment and manpower. Also, alternate Work to be identified if Work or a portion of, proposed cannot be done due to weather, equipment breakdown, delays in delivery, etc. Weekly Progress Reports shall be submitted at the end of each week.

.3 Quality Control Inspection Reports - The Contractor shall maintain a daily inspection report that itemizes the results of all Quality Control inspections conducted by the Contractor. The reports shall be submitted to the Departmental Representative with the Weekly Progress Report. A summary of all Quality Control inspections conducted to date shall be submitted by the Contractor with each Weekly Progress Report.

.4 "Design and Build" documents, Shop Drawings and Mix Designs – The Contractor shall submit all design drawings, shop drawings and mix designs required to fabricate and/or conduct the work a minimum fourteen (14) calendar days prior to fabrication / production.

.5 Progress Photographs Format:

.1 Electronic: .jpg files, minimum three (3) mega pixels.

.2 Submission requirements: one (1) set of electronic files.

.3 Identification: Name and number of project, description of photograph and date.

.4 Viewpoints: viewpoints determined by Construction Manager or Departmental Representative.

.5 Submission Frequency: prior to commencement of Work and weekly thereafter with progress statement, or as directed by Construction Manager or Departmental Representative.

.6 Submit all electronic pictures as part of closeout package.

.6 Submit an electronic copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction, weekly.

.7 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors immediately.

.8 Submit copies of incident and accident reports immediately.

.9 Submit daily extra work reports in accordance with Section 01 21 00 – Allowances.

.3 Project Completion Submittals

.1 Record Drawings -The Contractor shall submit copies of all Contractor's Drawings revised as necessary to record all as-built changes to the Work and the Contractor shall submit a set of Contract Drawings clearly marked to record as-built changes to the Work.

.2 Quality Control Records – The Contractor shall submit a .pdf electronic file containing an itemized set of project quality control documentation.

.3 All other documents noted within the Contract Documents, and under Section 01 78 00 – Closeout Submittals.

.2 The Contractor shall not construe the Departmental Representative's authorization of the submittals to imply approval of any particular method or sequence for conducting the Work, or for addressing health and safety concerns. Authorization of the programs shall not relieve the Contractor from the responsibility to conduct the Work in strict accordance with the requirements of Federal or Provincial regulations and this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor shall remain solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

.3 The Departmental Representative may, at their sole discretion, withhold payment from the Contractor for Work completed until acceptable submittal documents have been provided by the Contractor to the Departmental Representative.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 35 29 HEALTH AND SAFETY REQUIREMENTS

Part 1 General

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

.2 Health Canada / Workplace Hazardous Materials Information System

.1 (WHMIS) Material Safety Data Sheets (MSDS).

.3 Province of British Columbia / Alberta - Occupational Health and Safety Act, depending on the province where the Work is occurring.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.3 SAFETY ASSESSMENT

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

1.4 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work. This meeting may be combined with the Preconstruction meeting identified elsewhere.

.1 At this meeting the Contractor is required to complete and sign an Attestation to certify the Contractor will comply with the requirements set out in the Attestation and the terms and conditions of the Contract.

.2 A copy of the “Attestation and Proof of Compliance with Occupational Health and Safety (OHS)” form is part of the Invitation to Tender package.

.2 Parks Canada recognizes that federal Occupational Health and Safety legislation places specific responsibilities upon Parks Canada as owner of the workplace. In order to meet those requirements, Parks Canada has implemented a contractor safety regime to ensure roles and responsibilities assigned under Part II of the Canada Labour Code and the Canada Occupational Health and Safety Regulations are implemented and observed when involving contractor(s) to undertake work in Parks Canada workplaces, including on Parks Canada property.

1.5 REGULATORY REQUIREMENTS

.1 Do Work in accordance with the National Parks Act.

1.6 PROJECT / SITE CONDITIONS

.1 Work at site will involve contact with Alberta Occupational Health and Safety.

1.7 GENERAL REQUIREMENTS

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

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

1.8 RESPONSIBILITY

.1 The Contractor shall act as the Prime Contractor in all matters relating to Occupational Health and Safety. They shall conduct their work and make all such arrangements necessary to allow them to be accepted as such by the relevant Provincial Authorities.

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

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

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act, General Safety Regulation, Alberta.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORESEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or conditions occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.11 HEALTH AND SAFETY REPRESENTATIVE

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Co-ordinator must:

.1 Have minimum 2 years' site-related working experience specific to activities associated with roadway construction.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.12 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction and in consultation with Departmental Representative.

1.13 CORRECTION OF NON-COMPLIANCE

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

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

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected. The Contractor shall do as requested at their cost and no claim for time or additional costs will be accepted.

1.14 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written approval by the Departmental Representative.

1.15 POWDER ACTUATED DEVICES

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

1.16 WORK STOPPAGE

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

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 35 31 SPECIAL PROCEDURES FOR TRAFFIC CONTROL

Part 1 General

1.1 DESCRIPTION

.1 Supply, installation, maintenance and removal of Traffic Accommodation for the duration of the Contract or as described in this Section.

1.2 REFERENCES

.1 AT – Traffic Accommodation in Work Zones (latest edition)

.2 AT – Traffic Control Standards (latest edition)

.3 Manual of Uniform Traffic Control Devices for Canada, (MUTCD) distributed by Transportation Association of Canada. (latest edition)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Payment for Traffic Control as described in this Section, shall be made under **"Traffic Accommodation"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Payment for Traffic Accommodation will be on a monthly basis based on the percent of Contract Works completed, not to exceed the total lump sum bid price for Traffic Accommodation. Extra works are not to be included in determining the percent complete of the Contract.

.3 Payment for Traffic Accommodation will commence once the Contractor has implemented their accepted Traffic Management Plan and setup is accepted by the Departmental Representative.

.4 Items considered incidental to the Work include, but are not limited to:

.1 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.2 Traffic control at site access and egress points and for oversized deliveries on Red Rock Parkway.

.3 Keeping Red Rock Parkway clean and free of potholes at access and egress points, including sweeping and dust control as needed.

.4 Cost of snow removal required by the Contractor to complete the work identified in the Contract.

.5 The Contractor is responsible for clearing snow and maintaining their own access. Parks Canada does not plow Red Rock Parkway.

.1 The Contractor is advised that immediately adjacent to Red Rock Parkway is native fescue grassland which is to be protected. The design of road shoulders are not that of a typical roadway and special care is required when plowing to avoid damage to the grass.

1.4 GENERAL

.1 The Contractor shall develop and implement a Traffic Management Plan in accordance with AT – Traffic Accommodation in Work Zones (latest edition), except where specified

otherwise in the Contract Documents. The Traffic Management Plan will include plans specific to each roadway for this project.

.2 The Traffic Management Plan must duly consider the traffic volumes associated with the direction volume increases typically experienced on the lead up to weekends and/or special events.

.3 All traffic and warning signs shall be either bilingual or of a symbolic or pictorial type. All signs are to be selected from the Construction Signage Translation Database provided in the Contract Documents.

.4 All Changeable Message Sign (CMS) messages are to be selected from the preapproved database provided and are to be bilingual as shown.

.1 Any signage requiring translation that is not shown in the standard translation Contract Document must be approved by Parks Canada prior to fabrication.

.5 The Contractor shall coordinate traffic management procedures with other Contractors working in the immediate vicinity as well as collaborate with the Departmental Representative in respect to Traffic Management restrictions in the Network. The Contractor must also be prepared to attend traffic management and construction staging coordination meetings as requested by the Departmental Representative.

1.5 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 Do not close any lanes of road without approval of Departmental Representative. Before re-routing traffic erect suitable signs and devices in accordance with the requirements of the AT – Traffic Accommodation in Work Zones (latest edition), except where specified otherwise.

.3 Regardless of type of traffic control being used, **maximum period of delay to public traffic shall be 20 minutes**. Emergency vehicles (i.e., ambulance, RCMP, Park Warden) must be granted immediate passage at all times. The Departmental Representative reserves the right to reduce delay time for public traffic at times when specified delay results in excessive backup of public traffic.

.4 The Contractor shall provide competent supervision and/or contact personnel as required during non-working hours to ensure that safety flares, flashing beacons, signs, lights, etc., are in proper working order.

.5 Traffic control measures will be monitored by the Departmental Representative, who may require modifications of these measures from time to time to achieve satisfactory traffic flow, safety of traveling public and coordination with adjacent contracts.

1.6 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work that requires road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in the Traffic Management Plan submitted by the Contractor and approved by the Departmental Representative.

.3 All temporary signs that are used for longer than one day shall be mounted on wood or steel posts installed in the shoulder areas at locations accepted by the Departmental Representative.

.4 Place signs and other devices to standards and in locations recommended in AT – Traffic Accommodation in Work Zones (latest edition).

.5 All construction signs shall be installed to prevent incidental blow down or displacement and must remain in service throughout the construction period. Construction signage heights to be minimum 1.5m from ground to the bottom of the sign, or as per AT – Traffic Accommodation in Work Zones (latest edition), whichever is higher.

.6 As situation on site changes, Contractor to update their Traffic Management Plan outlining signs and other devices required for the project and submit for the acceptance of the Departmental Representative.

.7 Continually inspect and maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability, location and height.

.2 Cleaning, repairing or replacing signs as required ensuring clarity and reflectance.

.3 Removing or covering signs that do not apply to conditions existing from day to day or time to time.

1.7 CONTROL OF PUBLIC TRAFFIC

.1 Contractor shall provide competent flag persons, trained in accordance with, and properly dressed and equipped as specified in AT – Traffic Accommodation in Work Zones (latest edition).

.1 When public traffic is required to pass working vehicles or equipment, that block all or part of travelled roadway. This includes oversized deliveries along Red Rock Parkway.

.2 When vehicles are entering or exiting Work Site access points.

.3 When vehicles are entering or exiting gravel pits or borrow areas in the Park.

.4 When it is necessary to institute one-way traffic system or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

.5 When workers 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.

.6 Where temporary protection is required while other traffic control devices are being erected or taken down.

.7 For emergency protection when other traffic control devices are not readily available.

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

.9 At each end of restricted sections where pilot cars are required.

.2 During hours of darkness, Contractor shall determine requirements but as a minimum, flag persons shall be additionally equipped with a red signal hand-light of sufficient brightness to be clearly visible to approaching traffic and flagging stations shall be illuminated by overhead lighting. Signs indicating hazardous conditions and signs requiring increased attention shall be marked with flashers.

.3 No stoppage of traffic will be allowed for the periods specified in Section 01 14 00 – Work Restrictions, pertaining to Statutory Holiday or long weekend.

.4 If night shift operations are implemented on 2-lane undivided sections, the public traffic must be escorted through the work zone by pilot cars in both directions.

1.8 OPERATIONAL REQUIREMENTS

.1 Maintain existing conditions for traffic throughout period of Contract except that, when required for construction under Contract and when measures have been taken as specified herein and approved by Departmental Representative to protect and control public traffic, existing conditions for traffic to be restricted as follows:

.1 A schedule for all full Red Rock Parkway closures must be provided to the Departmental Representative at least four (4) weeks in advance of the planned closure.

.2 The Departmental Representative reserves the right to stop work in the case of excessive traffic delays. The Contractor shall do as requested at their cost and no claim for time or additional costs will be accepted.

.3 Provide the Departmental Representative with construction advisories for posting to the Official Alberta Traffic Advisor website (http: / / 511.alberta.ca /) and update advisories regularly to reflect the current and planned construction activities and highway closures. A minimum of 4 days notice is required for changes to the accepted TMP.

.4 Emergency vehicles are to be directed through the Work Site immediately once conditions are safe.

.5 No stoppage of traffic shall be allowed during inclement weather conditions.

.2 Maintain existing conditions for traffic crossing right-of-way.

1.9 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.10 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 35 43 ENVIRONMENTAL PROCEDURES

Part 1 General

1.1 REFERENCES

.1 Crandell Mountain Campground Reconstruction – Construction Environmental Management Plan – March 5, 2020 (CEMP).

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 Payment for Environmental Procedures and controls as described in this Section, shall be Lump Sum made under **"Environmental Controls"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Payment will be based on the percentages below, not to exceed the total lump sum bid price for Environmental Procedures. Actual percentages may vary based on Contractor's accepted schedule.

.1 10% upon acceptance of the Environmental Protection Plan (EPP)

.2 20% upon acceptance of initial Environmental controls setup

.3 5% for each monthly report submitted by the Qualified Environmental Professional (QEP) up to a maximum of 80%.

.4 20% for final site cleanup as accepted by the Departmental Representative and Environmental Surveillance Officer (ESO).

.3 Payment for Environmental Procedures will commence once the Contractor has implemented their accepted Environmental Protection Plan and setup is accepted by the Departmental Representative.

.4 Items considered incidental to the Work include, but are not limited to:

.1 All environmental mitigations required in accordance with the Contract Documents.

.2 Two initial rounds of revisions to the Contractor's submitted EPP.

.3 Monthly site audits and reporting by a registered QEP.

.4 Preparation and implementation of an Environmental Protection Plan in accordance with this Section 01 35 43 – Environmental Procedures, including certification by a registered QEP.

1.3 SUBMITTALS

.1 The Contractor is required to prepare and submit an Environmental Protection Plan in accordance with this Section 01 35 43 – Environmental Procedures and Section 01 33 00 – Submittal Procedures. The EPP document will be reviewed and accepted for use on the project by the Departmental Representative in collaboration with the Parks Canada designated ESO.

1.4 NATIONAL PARK REGULATIONS

.1 The Contractor shall ensure that all work is performed in accordance with the ordinances, laws, rules and regulations set out in the Canada National Parks Act and Regulations.

.2 The Contractor and any sub-contractors shall obtain a business license from a Parks Canada Administration Office, prior to commencement of the Contract. The business license must be valid for the Park in which the Work is occurring.

.3 All Contractor's vehicles are required to display a vehicle work pass from PCA. These permits may be obtained free of charge from the PCA Administration Office once a business permit has been obtained.

1.5 CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA)

.1 Execution of the work is subject to the provisions within the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) and subsequent amendments.

.2 The Contractor is required to implement all recommendations and mitigations and follow all procedures and processes whether supply, construction, administration or otherwise as described in particular in this Section 01 35 42 – Environmental Procedures, BMPs, and all Contract Documents.

.3 The Contractor shall prepare their Environmental Protection Plan (EPP) to implement the mitigations identified in this Section 01 35 42 – Environmental Procedures, BMPs, and all Contract Documents as a minimum but shall ensure that all environmental requirements under the Contract and associated with the Works are appropriately managed through their EPP processes.

.4 Where there is a discrepancy or inconsistency between this Section 01 35 43 – Environmental Procedures and other documents, this Section takes precedence over other documents.

.5 Failure to comply with or observe environmental protection measures as identified in the Contract Documents may result in the work being suspended pending rectification of the problems. The Contractor shall do as requested at their cost and no claim for time or additional costs will be accepted.

1.6 ENVIRONMENTAL BRIEFING AND ESO

.1 All staff employed at the construction site will be required to attend an approximate one (1) hour environmental briefing presented by PCA prior to their commencement of work on site. It is recognized that new employees may join the Contractors' work force after the initial round of "environmental briefing". In that case and as required, subsequent "environmental briefings" can be presented as numbers warrant, by arrangement with the ESO through the Departmental Representative. Also, some sub-trades may be present at the site for a short time, to perform once-only duties. In these cases, the "environmental briefing" will be replaced by the Contractor explaining the environmental sensitivity of the work location to the sub-trade worker(s), and reviewing highlights of personal conduct expected, with reference to a one-page briefing summary to be provided to the Contractor by the ESO. A copy of this summary will be provided to each sub-trade worker joining the work force at the site.

.2 Parks Canada will have an ESO attending the site to inspect the construction activity for conformance with the EPP. The ESO or alternate designated Parks Canada staff member will present the "environmental briefing". The ESO's main duties are to inspect the progress of the construction on an on-going basis to ensure compliance with environmental protection measures, and to provide guidance through the Departmental Representative, in the event of unanticipated environmental problems. Although the ESO

has authority to enforce National Parks Act violations, direction to the Contractor will be the duty of the Departmental Representative.

.3 The ESO is not to act as daily environmental monitor but shall check activities with the approved EPP to ensure compliance, at their discretion.

.4 The Contractor's QEP shall be responsible for ensuring all activities are conducted in accordance with the Contract Documents.

1.7 ENVIRONMENTAL PROTECTION PLAN

.1 The EPP is to be prepared and certified by a Qualified Environmental Professional. Certification by a QEP is considered incidental to the Works and no additional payment will be made.

.2 The EPP shall, at a minimum, incorporate and/or address all environmental mitigations included within the Contract Documents. Including, among other things, the mitigations included in the CEMP.

.3 Changes and/or revisions to the EPP may be required by the ESO as the Work progresses and more information becomes available. No additional payment will be made for changes and/or revisions to the EPP.

.4 The Contractor's EPP will detail how the work limits shall be marked and what procedures will be employed to ensure trespass outside these limits does not occur, to the satisfaction of the Departmental Representative and the ESO.

.5 The EPP will include how the Contractor will manage all environmental risks and specify site-specific details for implementing mitigation or achieving mitigation outcomes identified in particular in this Section 01 35 42 – Environmental Procedures, BMPs, and all Contract Documents.

.6 Spill Response and Erosion and Sedimentation Management Plans are to be included in the EPP, in accordance with this Section.

.7 QEP resumes are to be included in the EPP for Departmental Representative and ESO review.

.8 The Contractor shall submit the EPP in accordance with Section 01 33 00 – Submittal Procedures yet **allow no less than 2 weeks for the review of their EPP** and shall address and respond to all comments raised during the review within a maximum of 2 weeks.

1.8 RESTRICTED ACTIVITY PERMITS

.1 Prior to commencing any activity, the Contractor may be required to first obtain a Restricted Activity Permit (RAP) in consultation with PCA and Departmental Representative.

.2 Prior to mobilization, Contractor is to establish what RAPs are required for the Works, for the duration of the project. Include, in the project schedule, the acquisition of the application for RAPs, allowing no less than 2 weeks for review and acceptance by the ESO.

.3 Contractor shall list RAPs they require in the EPP.

.4 The Contractor is required to submit an application form to the Departmental Representative for each required RAP.

.5 RAP application details include, but are not limited to: Name of activity, start and end date of activity, location of Work, Contractor company name and address, Contractor contact name, phone number and email address and vehicle / equipment information.

.6 Following the application submission, the Contractor may be required to provide further details regarding the Work to PCA.

.7 Submission of a RAP application to the Departmental Representative does not permit the Contractor to commence the restricted activity.

1.9 CONSTRUCTION SITE ACCESS AND PARKING

.1 Points of access from the existing roadway to the various construction sites will be required. The Contractor shall review both short and long-term construction access requirements with the Departmental Representative, both at start-up and on an ongoing basis. In consultation with the Departmental Representative, the Contractor shall formulate an agreement for worker transportation to and from the work sites and where workers shall park their private vehicles.

.2 The Contractor shall ensure that the environment beyond the work limits is not negatively impacted or damaged by workers' vehicles or construction machinery and shall instruct workers so that the "footprint" of the project is kept within defined boundaries.

1.10 ACCIDENTAL FINDS

.1 It is possible that undocumented historic objects will be found within the Project limits. If significant features are encountered, stop Work in the immediate area, notify the Departmental Representative, take photographs of the findings and a GIS location reading.

.2 Significant features include items such as:

.1 Structural remains, high artifact concentrations, tent platforms, cornerstones, commemorative plaques, inscribed tablets, log cribbing retaining features, human remains, marked trees and other various items.

.2 If unsure, contact the Departmental Representative immediately.

.3 The Departmental Representative will notify the Contractor when Works can resume in the area.

.4 Should any process or requirements regarding archeological matters listed in this Section contradict the BMPs and other Contract Documents, this Section shall take precedence.

.5 All historical or archaeological objects found in the National Parks are protected under the National Parks Act and Regulations and are the property of Parks Canada. The Contractor and workers shall protect any articles found and request direction from the ESO or the Departmental Representative.

1.11 MISCELLANEOUS SITE MANAGEMENT CONTINGENCIES

.1 A RAP application will be required for any permitted Work camps or off-highway operation of a motor vehicle.

.2 A Contractor's office and work headquarters material laydown, equipment parking and storage area will be permitted in accordance with this Section and Section 01 14 00 - Work Restrictions.

.3 Removal and storage of snow shall be in accordance with Section 01 35 31 - Special Procedures for Traffic Control. If coordination is required, the Contractor shall coordinate through the Departmental Representative.

.4 The Contractor shall control blowing dust and debris generated from the construction site by means such as covering or wetting down dry materials and rubbish. Dust generated during the grade construction and or utilization of any temporary access roads must be kept at a reasonable level so as not to impart any hazard to the public traffic. Control measures must be initiated as and when required and may require increased vigilance at the discretion of the Departmental Representative.

1.12 SPECIFIC CONCERNS RELATIVE TO EROSION CONTROL AND SEDIMENTATION

.1 The Contractor's QEP shall prepare an Erosion and Sedimentation Management Plan (ESMP) for the components of the Contract that are undertaken in proximity to watercourses, wetlands or riparian environments. The plan shall be included in the EPP and prepared to the satisfaction of the Departmental Representative and ESO.

.2 The ESMP shall be prepared so as to ensure that there is no release into watercourses of sediments in levels that are deleterious to fish or that would harmfully alter, disrupt, or destroy fish habitat. Similarly, there is to be no sediment release into areas of vegetation growth or sensitive areas of sediments in levels that would adversely alter growing or hydraulic conditions. The target is 0 mg / L of TSS over background levels. The threshold is a maximum instantaneous increase of 25 mg / L over background levels when background levels are <250 mg / L, or a maximum instantaneous increase of 10% over background levels when background levels are >250 mg / L. This threshold shall not be exceeded.

.3 If necessary, on-site sediment control measures shall be constructed and functional prior to initiating construction activities.

.4 The regular monitoring and maintenance of all erosion control measures shall be the responsibility of the Contractor. If the design of the control measures is not functioning effectively, they are to be repaired. The Departmental Representative and ESO also will monitor erosion control performance.

.5 The site will be secured against erosion during any periods of construction inactivity or shutdown.

1.13 SPECIFIC CONCERNS RELATIVE WATER DIVERSIONS

.1 The Contractor's EPP shall describe the proposed locations and types of temporary stream or channel diversions, complete with construction procedures and timing of construction. Temporary stream or channel diversions shall be subject to the same environmental constraints as permanent watercourses and shall be built to pass, at least, the 10-year return period flood for the time of year during which the temporary diversion will be in place. Temporary stream or channel diversions that have been constructed during periods of low precipitation shall be completely removed prior to periods of increased precipitation unless otherwise approved by the Departmental Representative.

1.14 POLLUTION CONTROL

.1 The Contractor shall prevent any deleterious and objectionable materials from entering streams, rivers, wetlands, water bodies or watercourses that would result in damage to

aquatic and riparian habitat. Hazardous or toxic products shall be stored no closer than 100 metres from watercourses.

.2 A Spill Response Plan will be prepared by the Contractor's QEP as part of the EPP and shall detail the containment and storage, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products, to the satisfaction of the Departmental Representative and PCA and in accordance with all applicable federal and provincial legislation. The EPP shall include a list of products and materials to be used or brought to the construction site that are considered or defined as hazardous or toxic to the environment. Such products include, but are not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement and sand blasting agents.

.3 The containment, storage, security, handling, use, unique spill response requirements and disposal of empty containers, surplus product or waste generated in the use of any hazardous or toxic products shall be in accordance with all applicable federal and provincial legislation. Hazardous products shall be stored no closer than 100 metres from watercourses.

.4 An impervious berm shall be constructed around fuel tanks and any other potential spill area. The berms shall be capable of holding 110% of tank storage volumes and shall be to the satisfaction of the Departmental Representative and the ESO before start-up. Measures such as collection / drip trays and berms lined with occlusive material such as plastic and a layer of sand, and double-lined fuel tanks can prevent spills into the environment.

.5 The Contractor shall prevent blowing dust and debris by covering and/or providing dust control for temporary roads and on-site work by methods that are approved by the Departmental Representative or ESO.

.6 The Contractor shall provide spill kits at re-fuelling, lubrication, and repair locations that will be capable of dealing with 110% of the largest potential spill and shall be maintained in good working order on the construction site. The ESO and Departmental Representative prior to project start-up must approve these spill kits. The Contractor and site staff shall be informed of the location of the spill response kit(s) and be trained in its use.

.7 Timely and effective action shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. Parks Canada Dispatch shall be notified immediately of any spill immediately and can be contacted at a phone number provided in the Preconstruction Meeting. Following notification of Parks Canada Dispatch, the Departmental Representative and the ESO shall be notified. Spill response cards will be distributed during the initial Environmental Briefing with basic instructions and phone numbers.

.8 In the event of a major spill, all other work shall be stopped and all personnel devoted to spill containment and clean-up.

.9 The costs involved in a spill incident (the control, clean up, disposal of contaminants and site remediation to pre-spill conditions), shall be the responsibility of the Contractor. The site will be inspected to ensure completion to the expected standard and to the satisfaction of the Departmental Representative and ESO.

1.15 EQUIPMENT MAINTENANCE, FUELLING AND OPERATION

.1 The Contractor shall ensure that all soil, seeds and any debris attached to construction equipment to be used on the project site shall be removed (e.g. power washing) outside the National Parks before delivery to the work site.

.2 Equipment fuelling sites will be identified by the Contractor and approved by the Departmental Representative and the ESO. Except for chain saws, any fuelling closer than 100 metres any streams, wetlands, water bodies or waterways shall require the authorization and oversight of the Departmental Representative.

.3 Diesel and gasoline delivery vehicles, including bulk tankers shall be parked more than 100 metres from any streams, wetlands, water bodies or watercourses. Gravity fed fuel systems are not allowed. Manual or electric pump delivery systems shall be used. Fuelling personnel shall maintain presence at and immediate attention to the fuelling operation.

.4 Mobile fuel containers (e.g. slip tanks, small fuel carboys) shall remain in the service vehicle at all times. Protection and containment of approved fuel storage sites is addressed above.

.5 Equipment used on the project shall be fuelled with E10, and low sulfur diesel fuels and shall conform to local emission requirements. The Contractor is to ensure that unnecessary idling of vehicles is avoided.

.6 Oil changes, lubricant changes, greasing and machinery repairs shall be performed at locations approved by the ESO or the Departmental Representative. Waste lubrication products (e.g. oil filters, used containers, used oil, etc.) shall be secured in spill-proof containers and properly recycled or disposed of at an approved facility. No waste petroleum, lubricant products or related materials are to be discarded, buried or disposed of in borrow pits, turnouts, picnic areas, viewpoints, etc., anywhere within the National Parks.

.7 The Contractor shall ensure that all equipment is inspected daily for fluid / fuel leaks and maintained in good working order.

.8 Fuel containers and lubricant products shall be stored only in secure locations specified by the Departmental Representative. Fuel tanks or other potentially deleterious substance containers shall be secured to ensure they are tamperproof and cannot be drained by vandals when left overnight the National Parks. Alternatively, the Contractor may hire a security person employed to prevent vandalism in accordance with Section 01 52 00 - Construction Facilities.

1.16 OPERATION OF EQUIPMENT

.1 Equipment movements shall be restricted to the ‘footprint’ of the construction area. The work limits shall be identified by stake and ribbon or other methods approved by the Departmental Representative. Unless authorized by the Departmental Representative, activities beyond the work limits are not permitted. No machinery will enter, work in or cross over streams, rivers, wetlands, water bodies or watercourses, nor damage aquatic and riparian habitat or trees and plant communities. Some of the construction shall require working close to watercourses or water bodies. In these instances, the Contractor is to describe measures to be employed to ensure fugitive materials (e.g. rocks, soil, branches) and especially deleterious substances (e.g. chemicals) do not enter any watercourses, to the satisfaction of the Departmental Representative and ESO.

.2 The Contractor shall instruct workers to prevent pushing, placement, raveling, storage or stockpiling of any materials (e.g. slash, rock, fill or topsoil) in the trees bordering the right-of-way or into watercourses or water bodies.

.3 When, in the opinion of Parks Canada, negligence on the part of the Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond the designated work area, the Contractor shall be responsible, at their expense, for complete restoration including the replacement of trees, shrubs, topsoil, grass, etc., to the satisfaction of the Departmental Representative and ESO.

.4 Restrict vehicle movements to work limits.

.5 Workers private vehicles are to remain within the construction footprint.

1.17 FIRE PREVENTION AND CONTROL

.1 A fire extinguisher shall be carried and available for use on each machine and at locations within the plant in the event of fire. Basic firefighting equipment recommended (e.g. a water truck; minimum 500 Imperial gallons with 500 feet of fire hose and a pump capable of producing 45 psi water pressure at the nozzle, three shovels, two pulaskis, and two five gallon backpack pumps) shall be maintained at the construction site at a location known and easily accessible to all the Contractors' staff.

.2 A water truck may be necessary and will depend on the timing of the Contract (e.g. not required during winter or snow covered conditions).

.3 Construction equipment shall be operated in a manner and with all original manufacturers' safety devices to prevent ignition of flammable materials in the area.

.4 Care shall be taken while smoking on the construction site to ensure that the accidental ignition of any flammable material is prevented. Fires or burning of waste materials is not permitted.

.5 In case of fire, the Contractor or worker shall take immediate action to extinguish the fire provided it is safe to do so. Parks Canada Dispatch shall be notified immediately of any fire immediately and can be contacted at a phone number provided in the Preconstruction Meeting. Following notification of Parks Canada Dispatch, the Departmental Representative and the ESO shall be notified.

.6 Fires or burning of waste materials is not permitted.

1.18 WILDLIFE

.1 During the Environmental Briefing all personnel shall be instructed by the ESO on procedures to follow in the event of wildlife appearance near or within the work site and any other wildlife concerns.

.2 Avoid or terminate activities on site that attract or disturb wildlife and vacate the area and stay away from the immediate location if bears, cougars, wolves, elk or moose display aggressive behaviour or persistent intrusion. Extra care to control materials that might attract wildlife (e.g. lunches and food scraps) must be exercised at all times.

.3 Notify the ESO and Departmental Representative immediately about dens, litters, nests, carcasses (road kills), bear activity or encounters on or around the site or crew accommodation. Other wildlife-related encounters are to be reported within 24 hours. If the ESO or Departmental Representative is not available, Parks Canada Dispatch will be contacted at a phone number provided in the Preconstruction Meeting.

1.19 WASTE MANAGEMENT AND DISPOSAL

.1 The Contractor and workers shall dispose of hazardous wastes in conformance with the Environmental Contaminants Act and applicable provincial regulations while observing the Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments.

.2 All wastes originating from construction, trade, hazardous and domestic sources, shall not be mixed, but will be kept separate.

.3 Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried or discarded at the construction site or elsewhere in the National Parks. These wastes shall be contained and removed in a timely and approved manner by the Contractor and workers and disposed of at an appropriate waste landfill site located outside the Park. Construction waste storage containers, provided by the Contractor, shall be emptied by the Contractor when 90% full. Waste containers will have lids, and waste loads shall be covered while being transported.

.4 A concerted effort shall be made by the Contractor and workers to reduce, reuse and recycle materials.

.5 All efforts to prevent wildlife from obtaining food, garbage or other domestic wastes shall be made by the Contractor and Contract staff while undertaking their work in the National Parks. Such wildlife attractants shall not be stored at the work site overnight. Lunches, coolers and food products, including waste food products, shall be securely stored away from access by animals. Daily removal of food scraps, food wrappers, pop cans or other attractive products to bear proof containers is mandatory. It is incumbent on the Contractor to notify Parks Canada and make specific arrangements to have garbage collected by Parks Canada when using existing Parks Canada receptacles.

.6 The Contractor and workers shall immediately report any circumstances related to food / garbage (e.g. overflowing container or strong smell) and wildlife to the ESO or the Departmental Representative. If neither can be reached, the Contractor / worker shall immediately contact Parks Canada Dispatch at the phone number provided in the Preconstruction Meeting and report the details.

.7 Sanitary facilities, such as a portable container toilet, shall be provided by the Contractor and maintained in a clean condition.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 INSTREAM WORK

.1 In accordance with this Section, Section 01 14 00 – Work Restrictions, the National BMPs and all Contract Documents.

.2 A QEP hired by the Contractor will provide surveillance while working within 30 metres of a watercourse and during an instream works, in accordance with the Contract Documents. The QEP services are considered incidental to the Work and no additional payment will be made.

3.2 WATER EXTRACTION AND DISTRIBUTORS

.1 All water related activities are to be conducted in accordance with Decontamination Protocol for Parks Canada Fisheries and Aquatic Technicians – May 2017.

.2 Backflow prevention is required on all water trucks.

.3 All water trucks and water extraction equipment must be thoroughly cleaned prior to entering any Park. Proof of cleaning must be provided to the Departmental Representative and ESO for verification.

.4 Extraction of water within any National Park requires a RAP.

.5 Care must be taken by the Contractor to ensure extracted water does not enter another water body, other than the initial source of extraction.

.6 ESO may require water trucks to be cleaned prior to moving between sites within the Parks to mitigate the risk of cross- contamination of water bodies.

3.3 CLEARING AND GRUBBING

.1 Migratory bird least risk window is August 25 – April 7 and bat activity least risk window is October 1 – March 31.

.2 A RAP must be obtained prior to any vegetation removal. Clearing and/or tree removal will only be permitted outside of the migratory bird least risk window upon written approval by the Departmental Representative.

3.4 SPECIFIC CONCERNS RELATIVE TO SENSITIVE SITES AND ACTIVITIES

.1 Grade construction and paving activity near streams, rivers, wetlands, water bodies or watercourses must be undertaken with care to prevent damage to aquatic and riparian habitat or associated tree and plant communities. A large and mobile spill kit shall be kept at hand during construction at these sensitive sites in proximity to watercourses.

END OF SECTION

01 45 00 QUALITY CONTROL

Part 1 General

1.1 DESCRIPTION

.1 The Contractor is responsible for quality control inspection throughout every stage of the Work to ensure that equipment, materials and workmanship comply with the requirements of the Contract Documents.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-A23.2-04, Methods of Test and Standard Practices for Concrete

.2 AT - Standard Specifications for Highway Construction (latest edition)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 All Quality Control is to be done by the Contractor.

.2 Payment for Quality Control as described in this Section and the Contract Documents, shall be Lump Sum made under "**Quality Control**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to conduct the Quality Control requirements as specified in the Contract Documents.

.3 Payment will be made on a monthly basis prorated for the percentage of the total Work completed as determined by the Departmental Representative, subject to the Contractor being totally compliant with the requirements of this Section and with its own Quality Control Plan.

.4 The Departmental Representative may deduct an amount from any monthly payment so computed, for any quality management work required but not satisfactorily undertaken during that month.

.5 The Departmental Representative may reduce the total Lump Sum payable by the value of any quality management work required but not satisfactorily undertaken during the duration of the Project. The foregoing determinations will be made in the sole discretion of the Departmental Representative.

.6 Work that is deemed unacceptable in accordance with the Contract Documents will not be eligible for payment from the applicable Item for that Work.

.7 The Completion Certificate will not be issued if there are any unresolved Non-Conformance Reports.

.8 Payment for Quality Control may commence once the Contractor's Quality Control Plan has been accepted by the Departmental Representative.

.9 Items considered incidental to the Work include, but are not limited to:

.1 All Quality Control required in accordance with the Contract Documents.

.2 Monthly Quality Control audits and reporting by the Contractor's Quality Manager.

.3 Preparation and implementation of the Quality Control Plan in accordance with this Section and the Contract documents.

1.4 QUALITY CONTROL PLAN

.1 Contractor's Quality Control Plan shall be in accordance with AT - Standard Specifications for Highway Construction (latest edition).

.2 Submittals in accordance with Section 01 33 00 – Submittals Procedures.

1.5 TESTING BY THE CONTRACTOR

.1 Testing required to provide quality control to assure that the Work strictly complies with the Contract requirements shall include, but not be limited to:

.1 Testing all structural concrete, grout, reinforcing steel, asphalt concrete pavement, structural backfill, corrugated steel culverts, miscellaneous metals, concrete barriers, and all source acceptance testing; and

.2 All testing specified in the Contract Documents; and

.3 Any other testing required as a condition for deviation from the specified Contract procedures.

.2 Testing proposed shall be based on testing requirements in the latest edition of the AT Standard Specifications for Highway Construction in collaboration with current ASTM and CSA Standards or as stated below.

.3 All Quality Control technicians are to be certified by Canadian Council of Independent Laboratories (CCIL) for testing asphalt, aggregates and concrete, as applicable to the testing requirements for that item of Work.

.4 The Contractor shall be fully responsible and bear all costs for all quality control testing and shall conduct such testing in the following manner:

.1 Provide testing facilities and personnel for the tests and inform the Departmental Representative in advance to enable the Departmental Representative to witness the tests if it so desired;

.2 Notify the Departmental Representative when sampling will be conducted;

.3 Within one Day after completion of testing, submit test results to the Departmental Representative; and

.4 Identify test reports with the name and address of the organization performing all tests, and the date of the tests.

.5 Approval of tested samples will be for characteristics or use named in such approval and shall not change or modify any Contract requirements.

.6 Testing agencies, their inspectors, and their representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the Contract Documents, nor to approve or accept any part of the Work

.7 The minimum frequency for Quality Control testing during embankment construction will be as follows:

CONSTRUCTION TYPE	TEST TYPE	MINIMUM FREQUENCY OF TESTS
Embankment construction with fine grained or granular soil	Standard Proctor by: ASTM D698	1 per change in material or 1 per week, whichever is more frequent
	Field density by: ASTM D1556 / D1556M – Sand Cone ASTM D2167 – Balloon	1 per 1000 m^2 per lift, spaced randomly across full width of embankment

CONSTRUCTION TYPE	TEST TYPE	MINIMUM FREQUENCY OF TESTS
	ASTM D6938 – Nuclear	
	Proof Roll and or Rutting Test	As required by the Departmental Representative
Embankment construction with blasted rock or oversize granular	Field observation with daily field report; and a summary report signed and stamped by the Contractor's Engineer.	Full time during blasted rock placement
Road structure construction with granular materials	Standard Proctor by: ASTM D698	1 for each material type and 1 for each accepted change in material gradation.
	Field density by: ASTM D1556 / D1556M – Sand Cone ASTM D2167 – Balloon ASTM D6938 – Nuclear	3 tests per 50 m per lift; on centreline and on lt and rt fog lines
	Proof Roll and or Rutting Test	As required by the Departmental Representative
Culvert Installation	Field Density	Minimum three per 300 mm lift per culvert, spaced through the length and depth of the culvert backfill
Tests Prior to Concrete Discharge	C 143 / C143M-08 Slump of Hydraulic-Cement Concrete CSA A23.2-7C Air Content of Plastic Concrete by the Volumetric Method	One per truck load.
Tests During Concrete Pour	C 39 / C 39M-05e2 Compressive Strength of Cylindrical Concrete Specimens	Minimum of one cylinder for each pour and at least for every 30 cubic metres of concrete being poured.
Tests During Aggregate Production	ASTM C136 / C136M – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates Or C 117 – Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing	-Split Stockpiles: 1 for each stockpile for every 2 hours of production. - One main stockpile: for every 300 tonnes. - Blend Sand: 1 for every 100 tonnes during stockpiling. - Natural filler: 1 for every 50 tonnes during stockpiling.
Tests During Aggregate Production (cont.)	ASTM D5821 – Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate	Every second coarse aggregate sieve test
	C 117 – Sieve Analysis of Aggregates by Washing (Modified for Field Lab)	1 / shift on reduced sample obtained from combined samples from the crusher

CONSTRUCTION TYPE	TEST TYPE	MINIMUM FREQUENCY OF TESTS
Asphalt Products Tests	Tack and Prime	Mill certifications.
Tests During Asphalt Plant Mixing	C 136 / C 136M – Dry Sieve Analysis of Aggregate	1 of combined aggregate (off the belt) every 300 tonnes.
	D 2216 – Moisture Content	Aggregate: 2 tests / Lot Asphalt mix: 1 on first Sub-Lot and every second day.
	C 117 – Sieve Analysis of Aggregates by Washing (Modified for Field Lab)	1 / shift on reduced sample obtained from combined samples from the plant cold feed.
	D 5581– Resistance to Plastic Flow Using Marshall Apparatus	One set of three briquettes for 1,200 tonnes or Lot, whichever is less.
	D 6307 – Asphalt Extraction, Ignition Method	One / Sub-Lot.
	D 5 / D 5M – 13 Penetration of Bituminous Materials	One per Manufacturer's Batch. Samples should be taken for every 3000 tonnes of mix production.
	D 2171 / D 2171M – Viscosity	Contractor's Option
	D 2041 / D 2041M – Maximum Theoretical Density	One per sub-lot
Test During Asphalt Paving for Density Testing	AASHTO T 245- Resistance to Plastic Flow Using Marshall Apparatus	One 15 kg sample for every Sub-Lot or minimum 1 / day for field testing.
	Core Samples	At start, two cores for each Sub-Lot. After rolling pattern established, only one core for each Sub-Lot. All Marshall mix cores to be a minimum of 100 mm diameter, Superpave mixes shall require minimum 150 mm diameter cores.

★ *These are the minimum frequencies and the Contractor is responsible to assess the need to increase testing frequency, where aggregate source is not uniform or any other condition exists that may warrant it. QC frequencies may be reduced below this level, subject to the Departmental Representative's authorization, should the Contractor's QC plan be proven very effective.*
** Passing the minimum quantity of QC tests does not relieve the Contractor from the obligation of meeting the Contract requirements and any identified non-compliant works or products shall be rectified by the Contractor at their cost.*

1.6 CONTRACTOR'S QUALITY CONTROL PROGRAM

.1 The Contractor shall prepare a Quality Control Program. The purpose of the program shall be to ensure the performance of the Work in accordance with Contract requirements.

.2 The Quality Control Program shall be described in a Quality Control Plan. The Contractor shall submit the Manual to the Departmental Representative for review in accordance with Section 01 33 00 - Submittal Procedures. The Manual shall develop a logical system for tracking and documenting the Quality Control of the Work. A systematic format and a set of procedures patterned on a recognized Quality Control Standard will be acceptable, subject to review by the Departmental Representative.

.3 The Quality Control Plan shall include the following information:

.1 Distribution list, providing a list of names to whom the Manual shall be distributed;

.2 Title page, identifying the Contract, Contractor and copy number;

.3 Revision page, identifying the revision number and date of the Manual;

.4 Table of contents;

.5 Revision control, tabulating the revision number, date of revision, description of revisions and authorized signature;

.6 Details of measuring and testing equipment including methods and frequency of calibration;

.7 Purchasing details of all materials and equipment including procurement documents and vendor's Quality Control Program standards;

.8 Procedures for inspection of incoming items, in-process inspection and final inspection and tagging of all supply items;

.9 Details of special processes as identified by the Departmental Representative, including qualifications of personnel and certification;

.10 Procedures for shipping, packaging and storage of materials;

.11 Procedures for maintaining quality records and Statements of Compliance, including filing and storage of documents for a period of one year after Completion of the Works;

.12 Details of any non-conformance, including identification and recording of deficiencies, tagging procedures for "HOLD" or "REJECT" items, and final disposition of non-conformance forms by the Quality Control Manager;

.13 Inspection and test checklists, including tabulated checklists describing all manufacturing and delivery activities such as Inspection or Test, frequency of tests, description of tests, acceptance criteria of tests, such as verification, witnessing or holding tests and sign-off by the Quality Control Manager and the Departmental Representative, if the Departmental Representative witnesses the tests; and

.14 Forms used to ensure the application of the inspection and test checklist requirements. These forms shall be identified in the checklists and describe all testing requirements for Contract Document compliance.

.4 The Contractor shall appoint a full time qualified and experienced Quality Control Manager, 100% of their time dedicated to quality matters and who will report regularly to the Contractor's management at a level that shall ensure that Quality Control requirements

are not subordinated to manufacturing, construction or delivery. The Quality Control Manager shall be empowered by the Contractor to resolve quality matter and shall be onsite for the duration of the Contract.

.5 The Quality Control Plan shall include samples of all forms to be filled in by the Quality Control Inspectors. All forms shall be signed by the Quality Control Manager and submitted promptly to the Departmental Representative who will add its review signature.

.6 An independent check of all Work shall be performed by the Contractor. The Contractor shall appoint Quality Control Inspectors to ensure compliance of products and workmanship with Contract requirements. The same personnel may not be used to perform a given task and to check the quality and accuracy of the task.

.7 At completion of the Work a bound and itemized copy of all Quality Control documents and reports shall be prepared by the Contractor's Quality Manager and submitted to the Departmental Representative.

1.7 INSPECTION

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

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

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

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

.5 The Departmental Representative will provide the Contractor with an Approval to Proceed document, after performing an audit and confirming all requirements are met, as stated in Section 01 71 00 - Examination and Preparation. The Approval to Proceed must be signed by the Departmental Representative and the Contractor's representative before proceeding to the next layer.

.1 The Contractor shall provide a minimum of 48 hours notice to the Departmental Representative to arrange for an audit and Approval to Proceed.

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

.3 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.

1.9 ACCESS TO WORK

.1 Allow inspection / testing agencies access to Work, including but not limited to: off site manufacturing and fabrication plants, QC testing facilities and asphalt plants.

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

1.10 PROCEDURES

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

.2 Provide labour and facilities to obtain and handle samples and materials on site.

1.11 NON-CONFORMANCES

.1 A Non-Conformance can relate to any item within the Contract including but not limited to: materials testing, lines and levels, products, design-build items, traffic accommodation, quality control, environmental, health and safety, and other general procedural matters including communication protocols.

.2 Contractor's Internal Non-Conformance Report (NCR):

.1 Should the Contractor's QC reporting indicate that the Work is not in conformance, the Contractor's QC Manager shall issue an internal Non-Conformance Report (NCR) to the Contractor, with a copy to the Departmental Representative, including a response time.

.3 The Contractor shall then respond to the QC Manager, with a copy to the Departmental Representative, with respect to the NCR, within the specified time, with proposed resolutions and corrective actions. The Contractor and/or the QC Manager shall consult with the Departmental Representative on the resolutions.

.4 The Departmental Representative will accept or reject the proposed resolution and corrective action proposal.

.5 Payment for the Work itself may be withheld until the NCR issue is resolved.

.6 Owner Issued NCR:

.1 Should the Quality Assurance reporting indicate that the Work is not in conformance, the Departmental Representative will issue to the Contractor an NCR, including a response time.

.2 The Contractor shall then respond to that NCR, within the specified time, with proposed resolutions and corrective actions.

.3 The Departmental Representative will accept or reject the proposed resolution and corrective action proposal.

.4 Assurance testing and inspection will be performed to determine if the corrective action has provided an acceptable product. Acceptance and rejection will continue until the Departmental Representative determines that a quality product has been achieved.

.5 Payment for the Work itself may be withheld until the NCR issue is resolved.

.7 The Completion Certificate will not be issued if there are any unresolved Non-Conformance Reports.

.8 Appealing an NCR:

.1 If the Contractor disputes the validity of a finding in an NCR, the Contractor may file an appeal with the Departmental Representative. The Departmental Representative and the Contractor Representative will use all reasonable efforts to refine the area of dispute and to resolve the determination of conformance with the Contract.

.2 If the Departmental Representative and the Contractor Representative cannot come to a mutually agreeable resolution, the Work that is the subject of the Non-Conformance Report shall be re-evaluated by an independent third-party, selected by the Departmental Representative in consultation with the Contractor, at a test frequency equivalent to twice that specified in the Contract or to such other frequency as may be mutually agreed between the Departmental Representative and the Contractor.

.3 If the appeal testing confirms the non-conformance determination, all appeal testing costs will be borne by the Contractor. If the appeal testing shows that the Work did in fact meet the requirements of the Contract, all appeal testing costs will be borne by the Owner.

1.12 OPPORTUNITIES FOR IMPROVEMENT

.1 Should the QA review indicate that the Work is not in conformance, but the variance is deemed minor by the Departmental Representative, the Departmental Representative may issue an Opportunity for Improvement (OFI) report.

.2 The Contractor is encouraged to review the findings and undertake such modifications to the QC Plan and the work procedures as necessary to address the issue.

1.13 REJECTED WORK

.1 Remove defective Work, whether as a result of poor workmanship, use of defective products or damage and whether incorporated in Work or not. Replace or re-execute defective Work in accordance with Contract Documents, through the NCR process.

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

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

1.14 REPORTS

.1 In accordance with Section 01 33 00 - Submittals Procedures.

1.15 TESTS AND MIX DESIGNS

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

1.16 MILL TESTS

.1 Submit mill test certificates as required in the Contract Documents.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 52 00 CONSTRUCTION FACILITIES

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 All work of this section shall be incidental to Contract and will not be measured for payment.

1.2 OFFICES

.1 Provide temporary office for the use of the Departmental Representative which includes sufficient space with interior wall, 50% opening windows with mesh security screens and bars, floors and ceilings and the following furniture, equipment and facilities finished to the approval of the Departmental Representation .

.1 Office is to be sufficient size to accommodate required work activities of Departmental Representative's staff. The site office location is to be as approved by the Departmental Representative. The office shall be furnished and equipped with:

.1 3 desks / workstations and 3 chairs

.2 2 drawing layout tables

.3 Meeting table large enough for 18 people

.4 12 stackable meeting chairs

.5 4 filing cabinets with locking mechanisms

.6 2 bookcases (90cm wide x 30cm deep x 120cm high, complete with adjustable shelves)

.7 Wall mounted dry-erase board (122cm x 183cm), complete with dry-erase markers, erasers and dry-erase board cleaner

.8 Minimum 5 120-volt, ac duplex electrical receptacles

.9 3 wastepaper baskets

.10 Garbage and recycling bin

.11 1 small refrigerator, 1 microwave and 1 drinking water cooler

.12 Door entrance, complete with suitable lock and keys

.13 Marked and fully stocked first-aid case in a readily available location

.14 Standard printer / scanner / copier, capable of 11" x 17", with supply of paper, ink, toner and accessories

.15 Complete audio video system for WebEx meeting:

.1 The office shall be provided with a complete and operational audio video system for the purpose of conducting meetings whereby the attendees can view items such as drawings, schedules, documents and other information on a large TV screen and participants can attend from outside locations in the form of WebEx meetings.

.2 The system shall include all of the IT equipment and connections necessary to operate and be fully functional. The host shall be able to run the meeting from a laptop connected via HDMI cable,

with images visible on a minimum 60” 4k TV screen mounted on a wall so that the screen is conveniently visible to attendees seated at the conference table.

.3 The system must be capable of audio speaker and microphone function so that participants may call into the meeting via telephone when necessary.

.4 The Contractor shall be responsible to ensure that the complete system is operational for all site meetings, including provision of qualified IT staff to correct any problems and ensure that the system is up and running for each meeting.

.16 Dedicated high speed internet service (minimum 10Mbps or as approved by the Departmental Representative) through DSL, Cable and Wi-Fi as accepted by the Departmental Representative.

.17 Proper electrical, ventilation, cooling and heating equipment. The air conditioning and heating system shall be capable of maintaining 22° Celsius inside temperature throughout the year. The electrical lighting system shall be capable of providing a minimum 750 Lux using surface-mounted, shielded commercial fixtures with 10% upward light component.

.18 All-weather vehicle access and five parking spaces. The location shall provide gravel parking sufficient to accommodate meetings.

.2 The Contractor shall provide private washroom facilities adjacent to the office for the Departmental Representative’s staff only, complete with chemical type toilet and maintain supply of paper towels and toilet tissue.

.3 Maintain the office in a clean condition, provide cleaning service for office and washrooms at a minimum of once per week.

.4 Contractor shall provide IT support to ensure the internet connection is operational continuously throughout the duration of the Project.

.5 Contractor is responsible for dealing directly with utility companies for any utility hook ups require for the office, and for providing temporary services if necessary.

.2 Office to be on-site and maintained one (1) week after the Departmental Representative allows mobilization to site and not to be removed until the Contract Completion Date.

1.3 INSTALLATION AND REMOVAL

.1 Provide construction facilities to execute work expeditiously.

.2 Remove from site all such work after use.

1.4 SITE STORAGE / LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

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

1.5 CONSTRUCTION PARKING

.1 Provide and maintain adequate access and parking at the project site in areas approved by the Departmental Representative.

.2 Build and maintain temporary roads and provide snow removal during period of Work.

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

1.6 SECURITY

.1 If required by the Contractor, provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays. For extended shut-downs, the Contractor shall provide the level of security as required to protect the Work. The Contractor is advised that some random acts of vandalism to equipment have occurred within the Park. Cost of security personnel is incidental to the Work and no additional payment will be made.

.2 It is strongly advised that the Contractor consider the provision of security personnel.

1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.8 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations, ordinances and the EPP.

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

1.9 CONSTRUCTION SIGNAGE

.1 To be in accordance with Section 01 35 31 - Special Procedures for Traffic Control.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously and remove from site all such work after use.

1.3 HOARDING

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

1.4 GUARDRAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations.

1.5 WEATHER ENCLOSURES

.1 Not used.

1.6 DUST TIGHT SCREENS

.1 Not used.

1.7 ACCESS TO SITE

.1 Provide and maintain access roads, as may be required for access to Work.

1.8 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public in accordance with Section 01 35 31 - Special Procedures for Traffic Control.

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 In accordance with Section 01 14 00 - Work Restrictions.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED

END OF SECTION

01 61 00 COMMON PRODUCT REQUIREMENTS

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.2 REFERENCE STANDARDS

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

.2 Conform to these reference standards, in whole or in part as specifically requested in the Contract Documents.

.3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance in accordance with Section 01 45 00 – Quality Control.

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

1.3 QUALITY

.1 In accordance with Section 01 45 00 - Quality Control.

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

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

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

.5 Unless otherwise indicated in Contract Documents, maintain uniformity of manufacture for any particular or like item throughout building.

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

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

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

1.4 AVAILABILITY

.1 Immediately after signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are

foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work

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

1.5 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

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

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

1.6 TRANSPORTATION

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

1.7 MANUFACTURER'S INSTRUCTIONS

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

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

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

1.8 CO-ORDINATION

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

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

1.9 CONCEALMENT

.1 The Departmental Representative will inspect all work prior to any concrete pours. The Contractor shall notify the Departmental Representative 24 hours before any pour for inspection.

1.10 REMEDIAL WORK

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

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

1.11 FASTENINGS

.1 Not used.

1.12 PROTECTION OF WORK IN PROGRESS

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

Part 2 Products

.1 Materials shall be in accordance with AT – Standard Specifications for Highway Construction (latest edition), or as directed by the Departmental Representative.

Part 3 Execution

.1 Work shall be completed in accordance with AT - Standard Specifications for Highway Construction (latest edition), or as directed by the Departmental Representative.

END OF SECTION

01 71 00 EXAMINATION AND PREPARATION

Part 1 General

1.1 DESCRIPTION

.1 Survey and layout requirements for the Project. The Contractor shall have a qualified surveyor onsite each day work is occurring, and as otherwise required to meet the Contract Requirements.

1.2 REFERENCES

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

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Payment for Survey as described in this Section, shall be Lump Sum made under **"Survey"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Payment will be based on the percentages below, not to exceed the total lump sum bid price for Survey. Actual percentages may vary based on Contractor's accepted schedule.

.1 15% upon submission and acceptance of the initial site survey and required Survey Plan in accordance with Section 01 33 00 – Submittal Procedures.

.2 25% for submission final site survey and compilation of all survey data as accepted by the Departmental Representative.

.3 The remaining 60% is to be prorated each month based on the percentage of Contract works completed, extra work is not to be included when calculating percent complete.

.1 The following items will be required to receive monthly Survey payment:

.1 Submission of accepted cut reports throughout the month and demonstration of tolerance conformance.

.2 Submission of monthly survey as-built data.

.3 Payment is not to exceed 100% of the Survey bid item.

.4 Payment for Survey will commence once the Contractor has submitted their initial site survey and it is accepted by the Departmental Representative.

1.4 QUALIFICATIONS OF SURVEYOR

.1 Qualified surveyor, licensed to practise in Place of Work, acceptable to Departmental Representative.

1.5 SURVEY REQUIREMENTS

.1 The Departmental Representative shall identify the location of all work sites.

.2 The Contractor shall be responsible for all other survey and layout work identified in the Contract Documents and as required to complete the works including but not limited to:

.1 Performing a complete initial survey of the site, prior to commencing works, and providing the survey data to the Departmental Representative.

.1 Immediately following the initial survey, the Contractor shall compare the survey data to the Drawings. Any discrepancies between the geospatial information included within the Drawings, including at any tie-in points, shall be reported to the Departmental Representative within 14 days. Establishing lines and levels, locate and layout, by instrumentation.

.2 Staking for grading, cut and fill.

.3 Staking for slopes and top of embankment, sub-base course, base course and centreline for paving.

.4 Establishing culverts, manhole and drywell structures, invert elevations and locations.

.5 Incidental field adjustments, such as staking of embankments and culverts to match post-stripping ground lines and actual field drainage patterns.

.6 Layout for final lane markings, including those for intersection treatments.

.7 Re-establishing Reference Survey Control Points that are in danger of being damaged or destroyed.

.8 Ensuring survey instruments are properly calibrated prior to commencing Works.

.3 Survey Accuracy:

.1 All survey work shall be tied into the existing Control Monument Network with grid coordinates in UTM Zone 11 NAD 83. Departmental Representative will provide information on Control Points.

.2 All traverses will be closed and balanced. All level loops and traverses will be tied into the Control Monument Network.

.3 Secondary Control Points will be tied into and relative to Control Monument Network. Accuracy for Control Point surveys shall be to second order:

.4 Horizontal shall be less than $r = 5(d+0.2)$ where "r" is in cm and "d" is in km

.5 Vertical shall be less than $0.008 \times \sqrt{k}$ where k is distance in kilometres.

.4 Staking accuracy shall be:

.1 In bush areas, all elevations shall be within 100 mm of correct elevation. In open ground, all elevations shall be within 50 mm of correct elevation.

.2 In bush areas, all horizontal locations shall be within 100 mm of Design. In open ground, all horizontal locations shall be within 50 mm of Design.

.3 On road and pathway surfaces, all elevations shall be within 10 mm of correct elevation.

.4 All structures shall be within 20 mm of Design elevation and horizontal.

.5 The Departmental Representative will complete quality assurance construction survey measurements to verify grades and alignment, interim survey re-measurements for excavation limits and final neat line measurements to verify payment quantities for completed works.

.6 Contractor to provide cut sheet reports for all layers of gravel structure template to demonstrate that the defined construction tolerances have been achieved before

advancing to the next stage. Departmental Representative may verify that they are correct by performing an audit.

.1 Shots are to be taken at 10m intervals along centreline, mid-points and shoulders.

.2 The Departmental Representative will provide the Contractor with an Approval to Proceed document in accordance with Section 01 45 00 - Quality Control.

1.6 RECORDS

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

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

1.7 SUBMITTALS

.1 In accordance with Section 01 33 00 – Submittal Procedures.

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

.3 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

.4 On request of Departmental Representative, submit survey data.

.5 Submit certificate signed by surveyor certifying those elevations and locations of completed Work that conform to the Contract Documents.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 CROSS SECTIONS

.1 Cross sections will be taken at a maximum of 20 metre intervals. Additional cross sections will be taken where variations occur, including but not limited to: drainage channels, structures and/or other obstructions.

.1 Cross section intervals will be established on OG and are to be used for the duration of the project.

3.2 LAYOUT REQUIREMENTS

Survey Layout	Maximum Interval	Product	Tolerances
Right-of-way	At each point of deflection and at sufficient points between as to be continuously visible.	Stake showing station and offset, or flagging.	Sufficient accuracy to prohibit encroachment into adjoining properties.
Clearing and Grubbing	Same as Right-of-way.	Same as Right-of-way.	Sufficient accuracy to prohibit encroachment into adjoining properties.

Survey Layout	Maximum Interval	Product	Tolerances
Grading – Slope Stakes	10 m in rock cuts; 20 m in all other cases. (100 m for machine-controlled grading)	One slope stake each side, at top of cut or bottom of fill, showing station, offset, vertical dimension to subgrade, and slope, plus cut / fill transition stake. Non-standard ditches will be staked separately. An additional slope stake, where applicable, at the top of a rock cut after the removal of overburden.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m Vertical accuracy 25mm
Grading – Subgrade	20 m. (100 m for machine-controlled grading)	One stake at each side of the subgrade, showing station, offset and grade at the stake location, one at each break point, and one at centreline.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m Vertical accuracy per Specifications
Top of Sub-base	20 m. (100 m for machine-controlled grading)	One stake at each side of the sub-base course, showing station, offset and grade at the stake location, one at each break point, and one at centreline.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m Vertical accuracy per Specifications
Each Base Course	20 m. (100 m for machine-controlled grading)	One stake at each side of the base course, showing station, offset and grade at the stake location, one at each break point, and one at centreline.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m Vertical accuracy per Specifications
Final Base Course only	20 m. (100 m for machine-controlled grading)	One stake at each side of the base course, showing station, offset and grade at the stake location, one at each break point, and one at centreline.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m Vertical accuracy per Specifications
Culverts	Inlet and outlet.	One stake at each end of the culvert, plus an offset line, showing invert elevation and station.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m Vertical tolerance 0.020m
Storm Drainage, Subdrain, Watermain or Sanitary Sewer		Stakes showing locations of manholes, catch basins and other structures, and invert locations of pipe inlets and outlets, as well as stations.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m Vertical tolerance 0.020m

Survey Layout	Maximum Interval	Product	Tolerances
Paving	20 m	Stake showing station and offset, reference points (e.g. centerline offset, barrier, changes in paint lines etc.)	N / A
Level Course / Profile Paving	5 m grid pattern	5 m grid on pavement break points with cuts / fills.	N / A
Superelevation change	At percentage change points	Stakes showing station and superelevation percentage.	N / A
Signs		Stake at each sign location with stationing and sign designation.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m
Curb and Gutter	10 m and at alignment changes. Curb returns: 5 m or at quarter points, whichever is less.	Offset hub and nail with cut / fill to gutter grade, show stationing.	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m Vertical tolerance +/- 0.010m
Median / Island Curb	Continuous.	Paint line at face / edge of curb	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m
Pavement Marking	10 m, changes in line type, symbols	Paint dots and lines	+/- 0.30m – up or down chainage Offset from CL accuracy required +/- 0.030m

.1 This table shows layout details for general situations; particular circumstances may require more or less staking.

.2 The right-of-way limit will be laid out only where there is the work, including utility relocation, to be performed within three metres of it.

3.3 MACHINE-CONTROLLED GRADING

.1 Machine controlled grading may be used as a substitute for conventional grade staking under the following conditions:

.1 The equipment utilized shall be capable of meeting the Design vertical and horizontal tolerances and the use of machine-controlled equipment will in now way relieve the Contractor of the requirement to meet the specified tolerances.

.2 The Departmental Representative may require the Contractor to revert to conventional staking methods at any point during construction if the machine-controlled grading is producing unacceptable Work and the cost of doing so will be borne by the Contractor.

.3 The Departmental Representative may provide the Contractor the available electronic files of Design information without warrant with respect to the suitability for the purposes intended by the Contractor and the cost of making them suitable shall be borne by the Contractor. The Contractor remains responsible for completing the works as described in the Contract Documents,

even in the event that the electronic Design information provided is not consistent with the Contract Documents.

.2 As a minimum the Contractor shall provide an orientation stake every 100 metres showing station, offset and grade.

END OF SECTION

01 74 11 CLEANING

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.2 PROJECT CLEANLINESS

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

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative and in accordance with Section 01 35 43 - Environmental Procedures. Do not burn waste materials on site.

.3 Clear snow and ice in accordance with Section 01 35 31 – Special Procedures for Traffic Control.

.4 Keep roadway clean in accordance with Section 01 35 31 – Special Procedures for Traffic Control.

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

.6 Contractor to provide any on-site bear proof containers they require for collection of waste materials and debris.

.7 Remove waste material and debris from site at end of each working day.

.8 Dispose of waste materials and debris off site in accordance with Section 01 35 43 - Environmental Procedures.

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

.10 Provide adequate ventilation during use of volatile or noxious substances.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 The Departmental Representative and ESO may, at their total discretion, require the Contractor to suspend work activities until such a time as the Work Site is cleaned and debris, waste, and animal attractants are satisfactorily managed. The Contractor shall do as requested at their cost and no claim for time or additional costs will be accepted.

.13 Maintain excavation and trenches free of debris and waste.

1.3 FINAL CLEANING

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

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

.3 Remove waste products and debris including that caused by Owner or other Contractors.

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

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

.6 Inspect finishes and ensure specified workmanship and operation.

.7 Remove dirt and other disfiguration from exterior surfaces.

.8 Sweep and wash clean paved areas.

.9 Remove all construction debris and accumulated dirt from completed drainage systems; manholes; catch basins; and all piping.

.10 Clean hydroseed / hydro-mulch overspray from buildings, pavement, fences, light poles, and other unintended surfaces.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 77 00 CLOSEOUT PROCEDURES

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.2 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and all subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Departmental Representative's Inspection.

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

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Work is complete and ready for Final Inspection.

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

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

01 78 00 CLOSEOUT SUBMITTALS

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.2 CLOSEOUT SUBMITTALS

.1 The Contractor shall provide the following documents and information to the Departmental Representative prior to them being eligible for Final Completion as detailed in Section 01 77 00 – Closeout Procedures.

1.3 AS-BUILTS AND SAMPLES

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

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to the Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

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

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

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

1.4 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque Drawings and in copy of the Project Manual.

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

.3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

- .1 Field changes of dimension and detail.
- .2 Changes made by change orders.
- .3 Details not on original Contract Drawings.

.4 References to related shop drawings and modifications.

.4 Specifications: legibly mark each item to record actual construction, including:

.1 Changes made by Addenda and change orders.

1.5 FINAL SURVEY

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

1.6 WARRANTIES AND BONDS

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

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

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

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

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

.6 Co-execute submittals when required.

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

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

02 41 13 ASPHALT PAVEMENT REMOVAL

Part 1 General

1.1 DESCRIPTION

.1 Removal of existing asphalt pavement to depths and extents shown and as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment for Full Depth Asphalt Pavement Removal will be based on the square meters of asphalt removed and disposed of in accordance with the Contract Documents or as directed by the Departmental Representative.

.1 Payment for full depth asphalt removal shall be made under **"Asphalt Pavement Removal – Full Depth**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Items considered incidental to the Work include, but are not limited to:

.1 All operations involved in removal including but not limited to;

.1 Survey, cold milling or excavating, sweeping, loading, hauling, stockpiling and/or disposal and cleaning of remaining pavement surface

.2 Sawcutting as required for the works, regardless of the number of passes required.

.3 Overhaul.

.4 Cleaning of existing pavement shoulder, whether via sweeping or other methods.

.5 Maintaining areas of removed asphalt, including drainage, until completion of work.

.6 Disposal of removed asphalt material, outside of the Park, at a Contractor determined location.

.7 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.3 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

.4 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"** and no separate payment will be made to the Contractor.

1.3 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.4 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.6 DEFINITIONS

.1 Not used.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 PREPARATION

.1 Prior to beginning removal operation, the Contractor shall inspect and verify with the Departmental Representative, all areas, depths and lines of asphalt pavement to be removed.

.2 Have appropriate Traffic Control measures in accordance with Section 01 35 31 - Special Procedures for Traffic Control.

3.2 PROTECTION

.1 Protect existing pavement not designated for removal, concrete deck, concrete curb and barriers, light units and structures from damage. In event of damage, the Contractor shall immediately replace or make repairs to the satisfaction of the Departmental Representative at no additional cost.

3.3 REMOVAL

.1 Removal of asphalt by excavator, milling or other equipment capable of removing part of pavement surface to depths or grades indicated.

For Full Depth Asphalt Removal, it is anticipated that the depth of the existing asphalt pavement is 50 – 200mm deep. Existing asphalt pavement thickness is not uniform and will vary from one location to the next.

.2 Full depth asphalt pavement removal shall be done to the lines shown on the IFC Drawings or as designated by the Departmental Representative.

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

.4 Provide for suppression of dust generated by removal process to ensure a dust free Work Site.

.5 If the base course is disturbed by removal operations the Contractor will be required to rectify the base course, to the acceptance of the Departmental Representative, at the Contractor's cost.

.6 In low areas where water may pond, the Contractor shall cut drainage channels through the shoulders to prevent water from collecting in the applicable areas, prior to opening the lane(s) to traffic, as directed by the Departmental Representative.

3.4 STOCKPILING OF MATERIAL

.1 The Contractor shall dispose of removed asphalt material offsite at a Contractor determined location.

.2 Removed asphalt material shall become the property of the Contractor.

.3 If temporarily stockpiled onsite, the material shall be stockpiled by a loader and in such a manner as to prevent consolidation which means exercising caution and minimizing running equipment on the stockpiles. Trucks and trailers shall not drive on the pile.

.4 The height of the pile shall not exceed the height of the loader bucket.

3.5 FINISH TOLERANCES

.1 Finished surfaces in areas where asphalt pavement has been removed shall be within +/-5 mm of the grade specified and shall not be uniformly high or low.

.2 Where finished grade is not specified, the ground shall be restored to ensure minimum cover over underground utilities is achieved.

3.6 SWEEPING

.1 Loose material must be removed prior to opening the lane(s) to traffic.

.2 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand work and brooming as required. No extra payment will be made for sweeping or associated hand work.

END OF SECTION

02 41 99 DEMOLITION FOR MINOR WORKS

Part 1 General

1.1 DESCRIPTION

.1 Demolition and removal of existing structures as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA S350 [M1980(R1998)], Code of Practice for Safety in Demolition of Structures.

1.3 MEASUREMENT FOR PAYMENT

.1 Measure for payment for Demolition for Minor Works will be Lump Sum in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment will be made under "**Demolition for Minor Works**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Items considered incidental to the Work include, but are not limited to:

.1 Removal and disposal of existing septic fields including concrete battery bank buildings, concrete pads near kitchen shelters including grease traps and decommissioning of existing well.

.2 Decommissioning of the existing PCA generator and associated building and electrical appurtenances and returning to PCA.

.3 Removal, loading, hauling and disposal outside of the Parks for items specified.

.4 Asphalt removal, excavation, backfill or surface restoration other than that required elsewhere in the Contract or under other Unit Price Items.

.5 Surface restoration and/or repair to any damaged infrastructure, other than that required elsewhere in the Contract or under other Unit Price Items.

.6 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.7 All other demolition and removals noted in the Contract Documents.

.4 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

.5 Mobilization and Demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"** and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.7 SITE CONDITIONS

.1 Not disrupt services without prior approval to proceed being granted by the Departmental Representative.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 PREPARATION

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

.2 Locate and protect utilities in accordance with Section 01 14 00 -Work Restrictions.

.1 Preserve active utilities traversing the site in operating condition.

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

.3 Disconnect, cap, plug or divert, as required, existing public utilities within the roadway 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 the Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.

.4 Immediately notify the Departmental Representative should uncharted utility or service be encountered and await instruction in writing regarding remedial action.

3.2 PROTECTION

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, and landscaping features to remain in place.

.1 Provide bracing and shoring as required.

.2 Keep noise, dust, and inconvenience to occupants and public to minimum.

.3 Provide temporary dust screens, covers, railings, supports and other protection as required.

3.3 SALVAGE

.1 Salvage items for use in accordance with the Contract Documents. Remove items to be reused, store as directed by Departmental Representative and reinstall under the appropriate Section(s) of the Contract Documents.

.2 Salvaged materials damaged during removal due to the Contracts negligence shall be replaced at the Contractor's expense.

3.4 REMOVALS

.1 Remove items as indicated in the Contract Documents or as directed by the Departmental Representative.

END OF SECTION

02 81 01 HAZARDOUS MATERIAL

Part 1 General

1.1 REFERENCES

.1 Export and Import of Hazardous Waste Regulations (EIHW Regulations), SOR / 92-637.

.2 National Fire Code of Canada 1995.

.3 Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).

.4 Transportation of Dangerous Goods Regulations (T-19.01-SOR / 2001-286).

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.3 DEFINITIONS

.1 Dangerous Goods: Product, substance, or organism that is specifically listed or meets the hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: Any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.4 Workplace Hazardous Materials Information System (WHMIS): A Canada-wide system designed to give employers and workers information about hazardous materials used in the workplace. Under WHMIS, information on hazardous materials is to be provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by a combination of federal and provincial laws.

1.4 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Retain current Material Safety Data Sheet (MSDS) for each hazardous material required on site. Submit MSDS to Departmental Representative upon request.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Coordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.

.4 All explosives must be mixed outside of the Park and delivered to the site. No storage of explosives shall be allowed within the National Parks.

.5 Observe smoking regulations at all times. Smoking is prohibited in any area where hazardous materials are stored, used, or handled.

.6 Abide by the following storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers which are in good condition.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are not mixed.

.6 Store hazardous materials and wastes in a secure storage area with controlled access.

.7 Maintain a clear egress from storage area.

.8 Store hazardous materials and wastes in a manner and location which will prevent them from spilling into the environment.

.9 Have appropriate emergency spill response equipment available near the storage area, including personal protective equipment.

.10 Maintain an inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.7 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.8 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

1.6 TRANSPORTATION

.1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.

.3 If hazardous waste is generated on site:

.1 Coordinate transportation and disposal with Departmental Representative.

.2 Ensure compliance with applicable provincial laws and regulations for generators of hazardous waste.

.3 Use only a licensed carrier authorized by provincial authorities to accept subject material.

.4 Prior to shipping material, obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept the material.

.5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.

.6 Ensure that only trained personnel handle, offer for transport, or transport dangerous goods.

.7 Provide a photocopy of all shipping documents and waste manifests to Departmental Representative.

.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Departmental Representative.

.9 Report any discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

.1 Only bring on site the quantity of hazardous materials required to perform Work.

.2 Maintain MSDSs in proximity to where the materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

.2 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.3 Recycle hazardous wastes for which there is an approved, cost effective recycling process available.

.4 Send hazardous wastes only to authorized hazardous waste disposal or treatment facilities.

.5 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.6 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

END OF SECTION

03 10 00 CONCRETE FORMING AND ACCESSORIES

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of Concrete Formwork as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard Practices for Concrete.

.2 CSA-O86S1, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.

.3 CSA O121-[M1978(R2003)], Douglas Fir Plywood.

.4 CSA O151, Canadian Softwood Plywood.

.5 CSA O153-[M1980(R2003)], Poplar Plywood.

.6 CSA O437 Series-[93(R2006)], Standards for OSB and Waferboard.

.7 CSA S269.1-[1975(R2003)], Falsework for Construction Purposes.

.8 CAN/CSA-S269.3-[M92(R2003)], Concrete Formwork, National Standard of Canada.

.2 Council of Forest Industries of British Columbia (COFI)

.1 COFI Exterior Plywood for Concrete Formwork.

.3 AT - Standard Specifications for Highway Construction (latest edition)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings for formwork and falsework.

.3 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of British Columbia or Alberta, wherever the Work is occurring.

.4 Indicate method and schedule of construction, shoring, stripping, and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings and CAN/CSA S269.3 for formwork drawings.

.5 Indicate sequence of erection and removal of formwork / falsework as directed by Departmental Representative.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low volatile organic compounds (VOC's).

.5 Dispose concrete waste outside of the Park.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 Forms for unexposed surfaces are at the discretion of the Contractor subject to approval of the Departmental Representative.

.2 Forms for exposed surfaces including the cast in place concrete shall be new material, made of "Coated Formply", consisting of Douglas Fir substrate with resin-impregnated paper overlay and factory treated chemically active release agent.

.3 All form material for exposed surfaces shall be full-sized sheets, as practical. The re-use of any forms must have the acceptance of the Departmental Representative.

.2 The minimum acceptable forming for all exposed concrete where the pour height is 1.5 m or less shall have 18 mm approved plywood, supported at 300 mm maximum on centres. Where the pour height is greater than 1.5 m the minimum acceptable forming for all exposed concrete shall have 18 mm approved plywood, supported at 200 mm maximum on centres. Strong-backs or walers placed perpendicularly to the supports shall be employed to ensure straightness of the form.

.3 Metal bolts or anchorages within the forms shall be so constructed as to permit their removal to a depth of at least 50 mm from the concrete surface.

.4 Break-back type form ties shall have all spacing washers removed and the tie shall be broken back a distance of at least 20 mm from the concrete surface.

.5 All fittings for metal ties shall be of such design that, upon their removal, the cavities that are left will be of the smallest possible size. Torch cutting of steel hangers and ties will not be permitted. Formwork hangers for exterior surfaces of decks and curbs shall be an acceptable break-back type with surface cone, or removable threaded type.

.6 Cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in color.

.7 Form release agent shall be non-toxic, biodegradable, low VOC.

.8 Falsework materials shall conform to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork / falsework and ensure dimensions agree with Drawings.

.2 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.

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

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

.5 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1 / A23.2.

.6 Align form joints and make watertight and keep form joints to minimum.

.7 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless specified otherwise.

.8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

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

.10 Ensure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.11 Clean formwork in accordance with CSA-A23.1 / A23.2 before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.2 Remove formwork when concrete has reached 50% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Reuse formwork and falsework subject to requirements of CAN/CSA-A23.1.

END OF SECTION

03 30 00 CAST-IN-PLACE CONCRETE

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of Cast-in-Place Concrete as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 ABBREVIATIONS AND ACRONYMS

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.

.2 Type GU, GUb and GUL - General use cement.

.3 Type MS and MSb - Moderate sulphate-resistant cement.

.4 Type MH, MHb and MHL - Moderate heat of hydration cement.

.5 Type HE, HEb and HEL - High early-strength cement.

.6 Type LH, LHb and LHL - Low heat of hydration cement.

.7 Type HS and HSb - High sulphate-resistant cement.

.8 Fly ash:

.1 Type F - with CaO content less than 15%.

.2 Type CI - with CaO content ranging from 15 to 20%.

.3 Type CH - with CaO greater than 20%.

.9 GGBFS - Ground, granulated blast-furnace slag.

1.3 REFERENCES

.1 ASTM International.

.1 ASTM C260 / C260M Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494 / C494M Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017 / C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.6 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.7 ASTM D2240, Standard Test Method for Rubber Property – Durometer Hardness

.8 ASTM D1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).

.9 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.10 ASTM F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 CSA International

.1 CAN/CSA-A3000, Cementitious Materials Compendium. (Consists of A3001, A3002, A3003, A3004 and A3005)

.2 CAN/CSA-A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction.

.3 CAN/CSA-G40.20 / G20.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.

1.4 MEASUREMENT AND PAYMENT PROCEDURES

.1 Cast-In-Place:

.1 Cast-In-Place concrete for thrust blocks, pads, and other site concrete works will be considered incidental to the Contract and no additional payment will be made.

.2 Concrete placed beyond dimensions indicated will not be measured for payment.

.3 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, ducts, voids, fillets scoring and chamfers.

.4 No deductions will be made for volume of concrete less than 0.1 m2 in cross sectional area displaced by individual drainage openings.

.2 Items considered incidental to the Work include, but are not limited to:

.1 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.2 Supply and installation of joint fillers and joint sealers and concrete sealer.

.3 All tools, formwork, falsework, embedded metallic and non-metallic materials, including reinforcing, and access.

.3 Traffic Control required for this Work shall be incidental to **"Traffic Accommodati**on" and no separate payment will be made to the Contractor.

.4 Mobilization and demobilization required for this Work shall be incidental to "**Mobilization / Demobilization"** and no separate payment will be made to the Contractor.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: in accordance with Section 01 32 16 – Construction Progress Schedules, convene pre-installation meeting one (1) week prior to beginning concrete works.

.1 Ensure key personnel, site supervisor, Departmental Representative, speciality Contractor - finishing, forming, concrete producer and testing laboratories attend.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature, and test samples taken as per the Contract Documents.

.3 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

.4 Provide Departmental Representative with valid and recognized certificate from plant delivering concrete, in accordance with Section 01 33 00 – Submittal Procedures.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.2 Ensure testing laboratory and personnel are certified to CSA A283.

.5 In accordance with Section 01 33 00 – Submittal Procedures, provide proposed Quality Control procedures for review by Departmental Representative on following items:

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

.6 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.7 QUALITY CONTROL

.1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described this Section.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 days.

.5 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Contractor to CSA A23.1 / A23.2.

.1 Ensure testing laboratory is certified to CSA A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and departmental representative.

.4 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.5 Non-destructive methods for testing concrete: to CSA A23.1 / A23.2.

.6 Inspection or testing by the Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of their contractual responsibility.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.9 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 01 61 00 – Common Product Requirements.

.2 Concrete hauling time: deliver to site of Work and discharged within 120 minutes' maximum after batching.

.3 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1 / A23.2.

.4 Deviations to be submitted for review by Departmental Representative.

.5 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1 / A23.2.Products

Part 2 Products

2.1 DESIGN CRITERIA

.1 Alternative 1 - Performance: to CSA A23.1 / A23.2, and as described in this Section.

2.2 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in this Section.

2.3 MATERIALS

.1 Portland Cement: to CAN/CSA-A3000, Type GU.

.2 Blended hydraulic cement: Type HSb to CAN/CSA-A3000.

.3 Supplementary cementing materials: with maximum 25% fly ash replacement, by mass of total cementitious materials to CAN/CSA-A3000.

.4 Water: to CSA A23.1.

.5 Aggregates: to CSA A23.1 / A23.2.

.6 Admixtures:

.1 Air entraining admixture: to ASTM C260 / C260M.

.2 Chemical admixture: to ASTM C494 / C494M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1 / A23.2.

.1 Compressive strength: 20 MPa at 48 hours, 45 MPa at 28 days.

.2 Net shrinkage at 28 days: maximum 0.01 %.

.8 Curing compound: to CSA A23.1 / A23.2.

.9 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.10 Epoxy Grout: as indicated.

.11 Elastomer: as indicated.

.12 Steel Laminae: as indicated.

.13 Anchor Rods and Anchor Bolts: as indicated.

.14 Concrete sealers:

.1 Sikagard SN-40 Lo-VOC (or approved equivalent)

2.4 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1 / A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Uniformity: as required by CSA A23.1 / A23.2.

.2 Workability: free of surface blemishes, loss of mortar, colour variations, and segregation.

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: C-1.

.2 Compressive strength at 28 days age: 25 MPa minimum.

.3 Intended application: Substructure, Retaining Wall Panels and Coping.

.4 Aggregate size 20 mm maximum.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

.5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

Part 3 Execution

3.1 PREPARATION

.1 Obtain the Departmental Representative’s acceptance before placing concrete.

.1 Provide 24 hours’ notice prior to placing of concrete.

.2 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.

.3 Pumping of concrete is permitted only after acceptance of equipment and mix by Departmental Representative.

.4 Ensure inserts are not disturbed during concrete placement.

.5 Prior to placing of concrete obtain the Departmental Representative’s acceptance of proposed method for protection of concrete during placing and curing.

.6 Protect previous Work from staining.

.7 Clean and remove stains prior to application for concrete finishes.

.8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.9 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION / APPLICATION

.1 Cast-in-place concrete work in accordance with CAN/CSA-A23.1 / A23.2.

.2 Finishing and Curing.

.1 Finish concrete to CSA A23.1 / A23.2 unless noted otherwise.

.2 Schedule:

.1 Slab – broom finish.

.3 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1 / A23.2 to remove excess bleed water. Ensure surface is not damaged.

.3 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form construction and expansion joints as indicated.

.4 Install joint filler.

3.3 PROTECTION

.1 Protection and curing for concrete placed between October 01 and May 01 shall comply with following requirements in addition to cold weather requirements of CSA A23.1 / A23.2.

.1 Protect concrete with windproof shelter of canvas or other material to allow free circulation of inside air around fresh concrete.

.2 Do not let walls of shelter touch formwork.

.3 Provide sufficient space for removal of formwork for finishing.

.4 Use heating equipment approved by Departmental Representative.

.5 Vent products of combustion outside protective shelter: equipment to be capable of keeping inside air at constant temperature sufficiently high to maintain concrete at following curing temperatures:

.2 For initial 3 days: minimum temperature of 15 degrees C, maximum of 27 degrees C at concrete surfaces.

.3 Unformed surfaces: cure with burlap and water.

.1 Place two layers of damp burlap on surface of concrete.

.2 Overlap each strip by minimum 75 mm and secure against displacement by wind.

.3 Maintain burlap in place and keep thoroughly wet for seven days after placement.

.4 Formed surfaces:

.1 No additional curing will be required if formwork is left in place for seven days or more.

.2 If formwork removed in less than seven days, cure in manner specified for unformed surfaces for remainder of seven (7) day period.

.5 During curing period, only uncover areas needed for finish treatment. Re-cover and continue curing.

END OF SECTION

13 34 23 WATER TREATMENT PLANT

Part 1 General

1.1 DESCRIPTION

.1 Offsite construction / outfitting, transportation, and onsite installation of the Water Treatment Plant including all associated equipment and appurtenances as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

.2 The Contractor shall supply, install, and test all equipment and piping necessary to properly and fully complete the operating systems as specified herein and as shown on drawings, unless otherwise indicated. All materials, labour, tools, and appliances necessary for this work shall be furnished by the Contractor.

1.2 REFERENCES

.1 American National Standards Institute / American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA B300-[10] , Standard for Hypochlorites.

.2 ANSI/AWWA C210-[15] , Liquid Epoxy Coatings and Linings for Steel Water Pipe and Fittings

.3 ANSI/AWWA C213-[15] , Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings

.4 ANSI/AWWA C219-[17] , Bolted, Sleeve-Type Couplings for Plain-End Pipe

.5 ANSI/AWWA C512-[15] , Air-Release, Air / Vacuum, and Combination Air Valves for Water and Wastewater Service

.6 ANSI/AWWA C606-[15] , Grooved and Shouldered Joints

.7 ANSI/AWWA C653-[13] , Disinfection of Water Treatment Plants

.8 ANSI Z358.1-[14] , American National Standard For Emergency Eyewash And Shower Equipment

.2 American Society of Mechanical Engineers (ASME)

.1 B1.2-[17] , Gages And Gaging For Unified Screw Threads.

.2 MH / ASME PCC-1-[19] , Guidelines for Pressure Boundary Bolted Flange Joint Assembly

.3 American Society for Testing and Materials International, (ASTM)

.1 A182 / A182M-[19a] , Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

.2 A193 / A193M-[19] , Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

.3 A194 / A194M-[18] , Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

.4 A240 / A240M-[19] , Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

.5 A312 / A312M-[19] , Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

.6 A536-[84(2019)e1] , Standard Specification for Ductile Iron Castings

.7 C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

.8 D1622 / D1622M-14, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.9 D2000 - 18 Standard Classification System for Rubber Products in Automotive Applications

.10 D2564-[12(2018)] , Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

.11 D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics

.12 D6226-15, Standard Test Method for Open Cell Content of Rigid Cellular Plastics

.13 F593-[17] , Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Supply, outfitting of supplied equipment not specified in other pay items, and onsite installation of the shipping container:

.1 Measure for payment for the shipping container shall be Lump Sum, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Water Treatment Plant: Shipping Container**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools, equipment not covered by other pay items and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Supply of the chlorine equipment, day tank, and eye wash station and installation within the Water Treatment Plant:

.1 Measure for payment for the chlorine equipment (up to and including foot valves to injection quill), day tank with containment, and eye wash station with discharge collection shall be Lump Sum, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Water Treatment Plant: Chlorine Treatment**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Supply of the Water Treatment Plant HVAC equipment and installation within the Water Treatment Plant:

.1 Measure for payment for the HVAC equipment shall be Lump Sum, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Water Treatment Plant: HVAC Equipment**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.4 Supply of the Water Treatment Plant instrumentation and installation within the Water Treatment Plant:

.1 Measure for payment for the instrumentation shall be Lump Sum, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Water Treatment Plant: Instrumentation**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.5 Supply of the Water Treatment Plant piping, fittings, and valves and installation within the Water Treatment Plant:

.1 Measure for payment for the piping, fittings, and valves shall be Lump Sum, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Water Treatment Plant: Piping, Fittings, and Valves**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.6 Items considered incidental to the Work include, but are not limited to:

.1 Supply of the shipping container.

.2 Supply and installation within the Water Treatment Plant of new piping, fittings, valves, and treatment equipment as detailed.

.3 Outfitting the Water Treatment Plant with electrical power, lighting, a control panel, and a manual electrical transfer switch so that incoming power can be changed from the diesel generator to the future solar panel system in accordance with the Contract Documents.

.4 Transportation to site and installation of the outfitted Water Treatment Plant including coordination / connection to associated subgrade water and electrical lines.

.5 Startup and commissioning with required manufacturer's representatives.

.6 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.7 Traffic Control for this Work shall be incidental to "**Traffic Accommodation**" and no separate payment will be made to the Contractor.

.8 Mobilization and demobilization required for this Work shall be incidental to "**Mobilization / Demobilization**".

1.4 CONTAINERIZATION

.1 There is economic advantage associated with the relocation of man hours from the jobsite to prefabrication locations. This philosophy maximizes all preassembly techniques to reduce capital costs and improve overall project schedule.

.2 The work will include:

- .1 All components shown on the contract drawings including electrical. Refer to Division 26 for electrical scope.
- .2 Fabricate and assemble the packaged container which matches details and design intent outlined in this document as well as the Contract Drawings.
- .3 Meet scheduling window for onsite installation. Any and all delay costs shall be at the cost of proponent causing the delay.
- .4 Ship container to site with appropriate measures to safely transport to site.
- .5 Connect all pipework and any other components related to container.

.3 Pre-assemblies shall be assembled to:

- .1 Resist specified load due to acceleration both parallel and perpendicular to the direction of travel
- .2 Resist torsion loading caused by the raising or lowering of one pick-up or support point relative to all others

.4 Containerized Piping Aspects

- .1 Each prefabrication contractor should be given responsibility for ensuring that all module piping is adequately supported for shipping. Bolted connections and clamps should be utilized wherever possible. Temporary supports of this kind must be painted red for ease of identification and perhaps reuse. NOTE: Tack or stitch welding of pipe support is not permitted to the section. Clamp-bolted supports is to be used instead.
- .2 Open pipe ends must be covered for shipping using plastic caps and insulation terminations must be protected with a plastic wrap.
- .3 All module piping must be completed to the greatest degree possible.
- .4 Permanent pipe supports must be installed if possible, including: pipeshoes, anchors and guides. Some supports may be shipped loose with the relevant module if they cannot be installed for shipping.

.5 All valves and instruments should be installed if possible prior to shipment.

.6 Electrical is limited to container work. All field connection wiring to termination points shall be done in the field.

.7 In addition to the details specified in this section, any and all other costs or variables not identified in this section shall be borne by the packager / contractor.

.8 Any damage, mis-alignments, or design flaws as a result of the containerization shall be at the risk of the packager / contractor. No additional costs shall be submitted.

.9 Work may be done onsite at the contractor's preference, but this shall result in no change to cost, schedule, or related risks.

1.5 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and datasheets for all associated components of the Water Treatment Plant, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit manufacturer's data 2 weeks minimum prior to ordering materials for engineer review. Include manufacturer's drawings, information and shop drawings where pertinent.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by Professional Engineer registered or licensed in Alberta, Canada if design layout is to differ from contract drawings.

.4 Closeout Submittals:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit record documents, including directions for equipment as approved by engineer during review.

.3 Operation and Maintenance Data: submit equipment operation and maintenance data for incorporation into the manual.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.8 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials not installed in the Water Treatment Plant offsite to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 All equipment shall be adequately protected from damage during handling and from dust, dampness or any other injurious substance during delivery to the site, while at the site and after construction. Any damage which may occur during handling, shipping, or installation shall be made good by the Contractor at his expense. Equipment stored in unheated or open areas on the site shall be covered and provided with thermostatically controlled heaters of sufficient size to keep temperature of the equipment above the dew point.

.2 Storage areas shall be made accessible to the Departmental Representative at any time for the determination of the condition of storage.

1.9 INSPECTION

.1 The Departmental Representative reserves the right to inspect and test any material to be supplied under this specification at the manufacturer's plant or after arrival at the location specified for delivery. All materials, components, or parts which do not meet these

specifications, the standards, or are defective, shall be replaced by the Contractor at his expense to the satisfaction of the Departmental Representative.

Part 2 Products

2.1 SUBSTITUTIONS

.1 Supply approved equipment exactly as indicated by the drawings and specifications. Alternate materials may be substituted by the Contractor only if such substitutions have been approved in writing by the Departmental Representative.

2.2 PIPING

.1 Service:

.1 Fresh Water, Potable Drinking Water.

.2 Temperature range: 0 to 20 degrees Celsius

.3 Normal Working Pressure: 10 psi

.2 Hydrostatic Testing:

.1 Piping: 690 kPag (100 psig) for l hr with zero leakage

.2 Testing shall be done in shop like conditions (+15°C) with two recently certified 0- 200psi pressure gauges. Testing to be done on a fully assembled station nearing commissioning. Any and all substituted mechanical components (if applicable) shall be suitable for testing at the pressures indicated above with zero tolerance for exceptions. All testing to be witnessed by Senior Engineer and owner. Any delay or re- testing shall be at the contractors cost at the consultants and owner change out rate plus dis-imbursements.

.3 Inspection:

.1 100% Visual

.4 Pipe Welding:

.1 No welding of pipe, fittings or flanges.

.5 Pipe:

.1 Threaded: 15-40 mm (0.5”-1.5”) ASTM A312, TP304, SCH40S, TE

.2 Grooved: 50-600 mm (2”-24”) ASTM A312, TP304, SCH40S, PE

2.3 INSULATION AND THAWING CABLE

.1 The pipe shall be insulated using half shells by Urecon, Thermacor or Shaw Pipe with the following properties:

.1 Insulation Material: Rigid polyurethane foam with two-part polyurethane waterproofing coating.

.1 Thickness: Insulation 50mm (2in.), Polymer as recommended by the manufacturer.

.2 Density: (ASTM D1622) 35 to 48 kg/m^3 (2.2 to 3.0 lbs/ft^3).

.3 Closed cell content: (ASTM D6226) 90%, minimum.

.4 Water absorption: (ASTM D2842) maximum 4.0% by volume.

.5 Thermal Conductivity: (ASTM C518) 0.020 to 0.025 W/m°C (0.14 to 0.17 Btu * in/ft^2 * hr *°F)

.6 Temperature range: Cryogenic to 93.3°C (200°F)

.2 Jacket Material: Aluminum or 304 / 316 Stainless Steel.

.1 18-24 Gauge thickness

.2 Min. 50mm overlap with overlap to encourage water shedding

.3 304 / 316 Stainless steel gear clamps, every 300mm

.2 Pipe joints or fittings or valves shall be completed using factory formed half shells with valve operator extensions to ensure insulation thickness is maintained while allowing valve operation without removing insulation.

.3 Insulation shall be applied to all aboveground water piping and extend to 1.5m depth burial.

.4 Thawing cable:

.1 6 W/ft, 120V, 60hz, single phase, capable of running on a 15A breaker and appropriate for wet environment.

.2 End connection shall be Ground Fault Protected standard receptacle with a maximum length of 1.2m or as supplied by the manufacturer. Unit shall be outdoor, weatherproof rated. Running of the thawing cable will be by portable generator.

.3 Raychem H908 end connection with WinterGard Wet H612 cable or equal.

2.4 FITTINGS

.1 Threaded:

.1 15-40 mm (0.5”-1.5”) Class 3000, ASTM A182 — F304L SS, SW or TE

.2 50-400 mm (2”-16”) Grooved: AWWA C219, Ductile Iron ASTM A-536, GR65-45-12, Victaulic or approved equal.

2.5 JOINTS

.1 Flanges:

.1 15-400 mm (0.5”-16”) Grooved: AWWA C219, Ductile Iron ASTM A-536, GR65-45-12, Victaulic 741 or approved equal.

.2 Grooved End Couplings:

.1 Grooved end couplings shall comply with AWWA C606 for sizes less than 400 mm (16”). Couplings shall be ASTM A536, GR64-45-12 Ductile Iron. Victaulic or approved equal.

.2 All connections to civil piping shall have flexible type couplings as shown on drawings with remaining using rigid type.

.3 Gaskets:

.1 Non-Grooved End: Garlock Multi-Swell 3760 or approved equal, Thickness 3.2 mm (1 / 8”), Die Cut, NSF61 listed, aramid fibres in a nitrile elastomeric binder, continuous temperature rating 200 degrees Celsius.

.2 Grooved End: EPDM Synthetic rubber conforming NSF 61, and conforming to elastomers as designated in ASTM D-2000.

.4 Flange Assembly Bolts:

.1 Studs shall be ASTM SA-193-B8(M) studs and ASTM SA-194-8(H)(M) nuts. If any other type of bolt is installed or the bolt identification stamps are removed / missing, the contractor shall replace the stud bolt / nut at no additional cost to the owner. Studs shall protrude min. 2 threads past nut with a max of 12mm past the end of the nut.

.2 Grooved end Couplings and Flange Adaptors shall have ASTM F593-G2-CW oval neck track bolts with heavy F594-G2-CW Nuts.

.3 Assembly and torqueing shall be in accordance with AWWA MH / ASME PCC-1 or Victaulic specifications with Galling-resistant coating or lubricants.

.5 Threadolets:

.1 Not Allowed.

.6 Nipples:

.1 15-80 mm (0.5”-3”) ASTM A312 — TP304L SS, SSH 40S, TE / PE / GE.

2.6 BALL VALVES

.1 25-150 mm (1”-6”) ball valves shall be 1000psi working pressure rated, full port, two-piece body, TFE soft seated, blow-proof system, adjustable packing nut, floating body and 304 / 316 / CF8M Stainless steel. Victualic 726S, MA Stewart MAS G2 or approved equal.

2.7 SHIPPING CONTAINER

.1 The shipping container shall be 6.1 m by 2.4 m by 2.4 m (20’ by 8’ by 8’) and the colour shall be chosen by the Owner. All labels shall be removed. The Water Treatment Plant is not for winter use; therefore, the shipping container does not need to be insulated.

2.8 DUPLEX SODIUM HYPOCHLORITE METERING PUMP STATION

.1 Provided shall be two (2) new solenoid operated type sodium hypochlorite metering pumps, each rated 2.3 L / h @ 16 Bar. Units shall operate from 120V / 60hz / 1ph electric receptacle and pumping capacity vary in proportion to a 4-20 mA analog control signal.

.2 Pump package shall be pre-configured as follows:

.1 1 – Calibration column, PVC.

.2 1 - Adjustable pump back pressure valve.

.3 1 - Adjustable pump relief pressure valve.

.4 1 - Back / Relief Pressure setup gauge with isolation ball valve.

.5 Pulsation dampers as recommended by the supplier.

.6 Piping shall be of Sch. 80 PVDF material.

.7 Isolation ball valves provided as required.

.8 Pump and appurtenances shall be mounted on a PE or 316SS fabricated corrosion resistant wall-mounted stand.

.9 Each user interface display / keypad shall be front accessible.

.10 Threaded connections cannot be sealed with Teflon tape.

.11 The assembled package shall be pre-assembled, pre-piped, skid mounted and factory tested prior to shipment.

.3 Included shall be:

.1 1 – PE <5% sodium hypochlorite day tank (60 L) on 100% spill containment (capable of containing any leaks) with a modified top lid to drop in foot valves into tank.

.2 Water-tight seals installed around tubing passing through the PE tank lid.

.3 2 – Foot valves c/w 40 mesh strainers, each complete with single stage low level alarm float switch

.4 1 – Injector (quill) valve assembly c/w MNPT connection and isolation ball valve

.4 The chlorination system shall be suitable for sodium hypochlorite service and include an auto degassing valve and return line.

.5 The chlorination system shall be:

.1 ProMinent Gamma / x GMXa 1602 Wall Mounted Package

.6 The contractor or supplier shall perform field pressure testing to demonstrate to the contract administrator that the system is free of all leaks.

.7 Supplier shall provide a field technician to conduct 'on-site' pump testing commissioning and calibration prior to exposure to chlorine in the presence of the park's operating personnel and provide all necessary field training.

2.9 DEDICATED EYEWASH STATION

.1 Freeze resistant, 60.6 l (16 gal) gravity flow portable eyewash unit with heavy duty polyethylene tank, wall or counter mounted, and heated orange insulation jacket to temper water for remote site usage up to -20 F. Supplied with 0.9 m (3') drain hose and epoxy-coated steel bracket. Delivers 2 litres per minute (0.5 GPM) for 15 minutes. Unit shall include ANSI compliant sign.

.2 Tempering shall be set to ANSI rating with easy to read LCD, conduit and status light.

.3 Unit shall be fully assembled and tested to meet or exceed ANSI Z358.1 – 2014

.4 Electrical plug shall be 120V / 60hz / 1ph rated at 4A, GFI with manual reset and 2.7m (9ft) cord.

.5 Guardian Equipment G1540HTR or approved equal.

2.10 COMBINATION AIR VALVE

.1 Combination Air Valve shall be ASTM A536 ductile iron, fusion bonded epoxy coating to AWWA C213, newest edition.

.2 Floats and assemblies shall be ASTM A240 T316 stainless steel with soft seated (Buna-N) orifice seal.

.3 Valve shall meet AWWA C512 newest edition, with 300psi working pressure rating.

.4 Valve shall be NSF 61 certified.

.5 Val-Matic 201C.2DISV or approved equivalent.

2.11 PRESSURE INDICATOR

.1 Pressure Indicator shall be liquid filling bourdon tube type, stainless steel case, copper alloy wetted parts and shall fulfill IP54 ingress protection.

.2 Minimum 100 mm nominal face size.

.3 Wika Instruments 111.25 DN or approved equal.

2.12 ELECTROMAGNETIC FLOWMETER

.1 Electromagnetic flowmeter shall be sheet steel polyurethane coated housing, carbon steel flanges, hard rubber lining, stainless steel measuring tube, IP 67 protection class, and class 150 raised face ASME B16.5 nominal pressure with Hastelloy C22 electrodes, stainless steel AISI 316 Ti grounding rings, and die-cast aluminum (polyurethane-coated) connection box. Krohne ENVIROMAG 2100 Electromagnetic Flowmeter or approved equal.

.2 Signal converter to be100-230 VAC 60 hz 4-20 mA output. Krohne IFC100C Signal Converter or approved equal.

2.13 HVAC EQUIPMENT

.1 Duct:

.1 Galvanized steel

.2 Fan:

.1 Inline belt drive duct fan with a 0.25 HP, 115 Volts, 60 hz, single phase, 1725 RPM motor.

.2 Aluminum inlet grill, no filter required.

.3 Switch to be NEMA-1 rated. Unit to be operated such that when the door is opened, the fan is initiated.

.4 Greenheck BDF-80-4 or approved equal.

.5 Unit to include 4 standing spring base vibration isolators with colour coded, epoxy coated springs. Greenheck FDS-1-70 or approved equal.

.3 Inlet Damper:

.1 No flange vertical mount damper to be G-90 galvanized frame with mill-finish louvers. Pivot pins and rivets to be stainless steel and brushings to be nylon.

.2 Dayton 2FTX4 or approved equal.

.4 Outlet Damper:

.1 Vertical mount exhaust damper to be 24 ga galvanized steel, AMCA 511.

.2 Damper blades to be 0.4 mm (0.016”) roll formed aluminum with vinyl seals on the closing edge.

.3 Axle / bearing to be fiberglass reinforced nylon.

.4 Greenheck BD-330 or approved equal.

2.14 DISINFECTION PRODUCT

.1 Liquid sodium hypochlorite to AWWA B300 to disinfect Potable Water Reservoir, piping and all other surfaces containing potable water.

.2 Shall be conducted as per AWWA C651, C652, C653, newest edition.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials form site.

3.2 COATINGS

.1 Coatings shall be applied to all fabricated metal surfaces, with the exception of corrosion resistant materials, such as stainless steel, copper or brass. Standard coatings (epoxy, fusion bonded epoxy or hot dipped galvanized) on purchased equipment (valves, instruments, grooved end products) shall be exempt from additional coating.

.2 Water immersed:

.1 Applied to: wall penetrations and inside of piping, valves, and fittings.

.2 Coating system shall be suitable for exposure in immersed environments at ambient temperatures. The coating shall be compliant with AWWA C210, NSF 61 and approved for the proposed pipe / tank size. All surfaces should be assessed and treated in accordance with ISO 8504. Oil or grease shall be removed per SSPC-SP-1 solvent cleaning.

.3 Immersed surfaces shall be surface prepared to SSPC-SP-10 near white blast. If oxidation has occurred between blasting and application, the surface shall be reblasted to the specified visual standard. Surface defects revealed by the blast cleaning process, shall be ground, filled, or treated in the appropriate manner.

.4 Immediately following surface preparation, a prime coat of 2-component, owner selected colored high build epoxy shall be applied by spray to the paint manufacture's recommendations.

.5 This shall be followed by a final coat of 2-component, applied by spray to the paint manufacture's recommendations. Color selected by the owner.

.6 Grooved end piping and fittings shall be internally coated for immersed service, as well as on the outer gasket sealing band between each pipe groove and the end of the pipe or fitting.

.7 Flexible rubber jacketed cables, liquid tight flexible conduit, nameplates, brass / copper, aluminium and stainless steel components and valve internals shall not be painted.

.3 Dry Exterior:

.1 Applied to: outside of all valve bodies, outside of piping and fittings, and supporting sub-frame(s).

.2 Coating system shall be high durability (15+ year) rated, AWWA C210 and suitable for a classification C2 low corrosively environment per ISO Standard 12944. All surfaces should be assessed and treated in accordance with ISO 8504. Oil or grease shall be removed per SSPC-SP-1 solvent cleaning.

.3 Surface prepare to SSPC-SP-6 commercial blast. If oxidation has occurred between blasting and application, the surface shall be reblasted to the specified visual standard. Surface defects revealed by the blast cleaning process, shall be ground, filled, or treated in the appropriate manner. Hold point for NACE

inspector to approve prior prime coating, schedule inspector to minimize hold time to minutes.

.4 Immediately following surface preparation a prime coat of 2-component, primer grey coloured epoxy anti-corrosive primer shall be applied by spray to the paint manufacture's recommendations.

.5 This shall be followed by a final coat of 2-component, owner selected colour epoxy applied by spray to the paint manufacture's recommendations.

.6 Flexible rubber jacketed cables, liquid tight flexible conduit, nameplates, brass / copper, aluminium and stainless steel components shall not be painted.

.4 Application Quality:

.1 The Supplier shall be responsible for self-inspection of the coating systems as outlined, but subject to independent inspection at all times.

.2 Only an approved NACE applicator shall be utilized for surface preparation and coating systems. The NACE certified coating inspector shall, through the Contractor, provide the Departmental Representative with a letter of verification upon completion of all required coating applications.

.5 Field Touch Up Procedures:

.1 Damage to shop applied coatings occurring in storage, erection or installation shall be repaired to standards equal to the project specifications.

.2 Immediately prior to repairing damaged or unpainted surfaces, and before the specified surface preparation is carried out, all grease, oil, dirt, and foreign matter shall be removed as per SSPC SP1.

.3 Edges of sound remaining coating on the surface shall be feathered by sanding / grinding prior to painting.

.4 Gloss paint surfaces shall be sanded or abraded to provide a bond for successive coats.

.5 The minimum coating requirements for spot coating repairs shall be as follows:

.1 No corrosion, primer exposed: Apply one or more finish coats to restore specified film thickness.

.2 No corrosion, primer damaged: Clean area to substrate and reapply the specified system

.3 Rusted areas: After cleaning to the original standard of surface cleanliness, reapply specified system

.6 All areas to be repaired shall be inspected by the coating inspector before, during and after such repairs to confirm compliance with the foregoing and / or the project specifications.

3.3 PIPE INSTALLATION

.1 Assemble piping using fittings manufactured to ANSI or AWWA standards.

.2 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.3 The types and sizes of pipes to be used shall be as specified and shown. Where sizes of small pipe are omitted from the drawings and not mentioned in the specifications, the sizes to be used shall correspond to the latest addition of AWWA.

.4 All pipe shall be carefully placed and supported at the proper lines and grades, and where possible shall be sloped to permit complete drainage. Piping runs shown on the drawings shall be followed as closely as possible, except for minor adjustments to avoid architectural and structural features. If major relocations are requested, they shall be submitted to the Departmental Representative for approval.

.5 In erecting the pipe a sufficient number of threaded unions, grooved end or flanged end type joints shall be used to allow any section or run of pipe to be disconnected without taking down adjacent runs. The provision of an adequate number of appropriate take-down fittings must be rigidly adhered to whether or not such fittings are indicated on the drawings. Take-down fittings shall also be provided for removal of valves and other appurtenances. Where piping passes through concrete or masonry walls, take-down fittings shall be employed as near the wall as possible.

.6 Wherever a metallic nonferrous pipe or appurtenances is connected to a ferrous pipe or appurtenance, dielectric unions of an acceptable type shall be used to insulate pipe sections. Wherever copper pipe is supported from hangers, it shall be suitably insulated from the hangers.

.7 The interior of all piping shall be cleaned after assembly and before connecting to equipment.

.8 Pipes shall be installed in accordance with the manufacturers instructions and insulated where shown as per the Contract drawings. Factory formed insulation half shells shall be sized to fit the thawing cables under the insulation, and around all valve shapes. Pipe supports shall be attached to the final outside jacket to minimize thermal bridging.

.9 Thawing cables shall be handled and installed in accordance with the manufacturer's instructions.

.1 The thawing cables shall be installed in a spiral around the pipe / valves in all installation orientations as the cable is intended to thaw the frozen pipe rather than the heat tracing. Additional cable length shall be placed around areas near areas without insulation or valves. Obtain approval from the Departmental Representative prior to covering thawing cables with insulation.

.2 The Contractor shall adhere to the minimum length of cable per length of pipe ratio recommended by the manufacturer for thawing purposes.

.3 Thawing cable end connections shall be at a convenient location for generator connection and confirmed with the Departmental Representative during construction.

.10 Pipe Supports:

.1 Piping shall be properly supported vertically and horizontally by wall brackets, pipe hangers and pipe support. Unless otherwise specified, supports for all horizontal runs of all sizes or pipe shall be spaced in accordance with good practice.

.2 The Contractor shall provide special pipe supports where required.

.11 Pipe Cutting:

.1 The Contractor shall perform all work of cutting pipe and fittings or special castings necessary to the proper and accurate assembly, erection and completion of the work. All pipe shall be cut to fit accurately with smooth edges and faces.

.12 Pipe Threads:

.1 Pipe ends shall be reamed to a full bore of the pipe. Threads shall conform in dimension and limits of size to ASME B1.2, taper jointing thread. In making up threaded joints, an accepted thread lubricant shall be applied to the male threads only.

.13 Flanged Joints:

.1 Flanged joints shall be made up square with even pressure upon the gaskets and shall be perfectly watertight.

.14 Pipe Grooving:

.1 Manufacture of grooved end products must provide start-up training to contractor and provide as required field / shop “hands-on” field support during construction.

.15 Cold Welding:

.1 The PVC pipe and socket fittings shall be jointed by cold welding through use of solvent based cement in accordance with ASTM D2564 and manufacturer's recommendations.

.16 Steel Pipe Joining by Welding:

.1 Not permitted unless indicated on the contract drawings.

.17 Install in accordance with AWWA, NPC, Alberta’s Plumbing Code, and local authority having jurisdiction.

.18 Lay pipes to manufacturer’s standard instructions and specifications.

.19 Join pipes in accordance with manufacturer’s recommendations.

.20 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.21 Do not exceed permissible deflection at joints as recommended by the manufacturer.

.22 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.23 Cut pipes in an 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.

.24 Align pipes carefully before jointing.

.25 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.

.26 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.27 Complete each joint before laying next length of pipe.

.28 Minimize deflection after joint has been made.

.29 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer’s recommendations.

.30 When work stoppage occurs, block pipes in an approved manner to prevent creep during down time.

.31 Protect valves and appurtenances from freezing.

3.4 VALVE AND FITTING INSTALLATION

.1 Install valves and fittings to manufacturer's recommendations at locations indicated.

.2 Piping, valves, and fittings shall be properly supported by supports as shown on the drawings. Location and configuration of supports is as shown on the drawings and described in these specifications. A 6 mm thick pad of hard neoprene rubber shall be placed between the pipe and its supports to ensure freedom of lateral movement.

.3 Valves shall be installed to the details shown on the drawings. The interior and exterior of flanged valves shall be thoroughly cleaned and any rust deposits or foreign matter on the valve flanges shall be removed before the valves are installed.

3.5 EYE WASH STATION INSTALLATION

.1 Water flow pattern to be positioned between 83.8 cm and 134.6 cm (33"-53") from the floor and at least 15.3 cm (6") from the wall or nearest obstruction.

.2 Unit to include a containment structure to capture used eye wash fluid.

3.6 FLUSHING AND DISINFECTING

.1 Engineer to provide flush and chlorination parameters prior to starting, matching AWWA standards.

.2 Flushing and disinfecting operations shall be witnessed by the Departmental Representative. Notify the Departmental Representative at least 24 hours before the proposed date when disinfection will commence.

.3 Provide connections and pumps as required.

.4 Flush and disinfect all components in contact with raw or treated water to AWWA suitable standard, newest edition.

.5 Solids flushing is to occur first due to remoteness of site followed by disinfection, chlorine flushing at a lower flow rate (using the well pump), followed by bacterial testing before commissioning. Flushing is to be sufficiently de-chlorinated for discharge into natural surrounding water bodies and continue until all heavily chlorinated water, pipe lubricant or other materials that may have entered the Water Treatment Plant system during construction have been expelled.

.6 Dechlorination of the chlorinated water is required before discharging the water to the environment in order to meet the regulatory requirements of the Alberta Environmental Protection. Dechlorination, is to be performed by adding neutralizing chemicals (AWWA 651, Appendix A, newest edition) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

.7 Bacteriological samples are to be collected by the Departmental Representative in approved sample bottles obtained for the Provincial Laboratory of Public Health or the local Health Unit. The sample bottles are sterilized and contain a dechlorination reagent. Never rinse sample bottle before testing. The locations where each sample is taken must be clearly identified on the form, PH 108, provided with each sample bottle. Indicate the sample is from the newly constructed Water Treatment Plant. The Departmental Representative is to direct the location each sample is drawn from and the corresponding identification number from the public health form, PH 108.

.8 The Water Treatment Plant system will not be put into service until all excess pipe lubricant has been flushed from the system and the results of the bacteriological tests

have been provided to the Departmental Representative stating the water is free from contamination. Once satisfactory water quality and bacteriological test results have been confirmed, the contractor will commission the Water Treatment Plant.

.9 If the initial disinfection fails to produce satisfactory bacteriological samples, the Water Treatment Plant system may be reflushed and re-sampled. If check samples show the presence of coliform organisms, then the Water Treatment Plant system shall be rechlorinated and flushed until satisfactory results are obtained.

END OF SECTION

26 05 03 COMMISSIONING - ELECTRICAL

Part 1 General

1.1 DESCRIPTION

.1 This section includes the materials and installations required for commissioning.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1

.2 Guidelines for Commissioning Systems, ASHRAE (current edition)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Operating and Maintenance Manuals

.1 Provide operating and maintenance manuals in accordance with the requirements of this section and Section 26 05 00 – Common Work Results – Electrical.

.2 Submit the number of manuals as indicated.

.3 Provide the services of electricians, manufacturer's representatives and technicians required to provide information which is necessary for the manuals. Note that a substantial completion certificate will not be issued until such a time as the manuals have been submitted in their finals accepted form.

.4 Operating and maintenance data shall be submitted to the Departmental Representative for review. A list of comments will be generated and returned to the Trade Contractor as necessary. This process will continue until the manuals are acceptable to the Departmental Representative.

.5 The manuals shall be set up by the specification Section. Provide all information appropriate for each section.

.1 Review Certificates.

.2 Letter of Guarantee.

.3 List of Suppliers and Contacts.

.4 Single Line Diagrams.

.5 Distribution Panels.

.6 Lighting and Power Panels.

.7 System Coordination and Arc Flash.

.8 Lighting Systems including fixtures, ballasts, lamps.

.9 Switching and Dimming Systems.
.10 Wiring Devices.
.11 Specialties.

.3 Data for Operating and Maintenance Manuals
.1 Only data associated with actually installed systems should be included in Operating and Maintenance Manuals.
.2 Include in operations and maintenance data:
.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature is not acceptable.
.3 Wiring and schematic diagrams and performance curves.
.4 Names and addresses of local suppliers for items included in maintenance manuals.
.5 Copy of reviewed shop drawings.
.6 Copies of all certificates including:
.1 Electrical Safety Authority (ESA) final certificate.
.2 Life safety systems verification certificate and test.
.3 Commissioning reports.

.4 Closeout Submittals
.1 Provide operation and maintenance data for battery charger for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
.2 Operation and maintenance instructions covering design elements, construction features, component functions and maintenance requirements to permit effective operation, maintenance and repair.
.3 Copy of approved shop drawings.
.4 Technical description of components.
.5 Parts lists with catalogue numbers and names and addresses of suppliers.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.7 GENERAL TESTS

.1 Contractor shall provide portable generator, temporary cabling, fuel, and any other required items to provide temporary power to the site for the duration of testing, commissioning, training, and winterization of all systems on site requiring electrical power.

.2 Conduct and pay for tests of the following systems:
.1 Power distribution systems.
.2 All circuits, including power, data, control and communication circuits.

.3 Lighting and associated controls.

.4 Provide two infrared Thermo Scans of the entire new and existing normal emergency power electrical distribution systems. The schedule for the first scan to be completed is at building turn over and the second scan shall be conducted at the ten month point. Submit three copies of test results.

.5 Motors, heaters and associated control equipment.

.6 All systems.

.3 Give sufficient prior notice to the Departmental Representative of the proposed time of the tests so that he can be represented at the tests if he so decides. Submit all test reports in triplicate to the Departmental Representative for his review and records.

.4 Submit test results with all operation and maintenance data.

.5 Test all systems in accordance with details in appropriate sections.

.6 Testing methods and test results shall be in accordance with CSA, the Electrical Code and regulations of the supply authority, other authorities having jurisdiction and in accordance with other sections of these Specifications.

.7 Remove and replace with new materials all conductors that are found to be shorted or grounded.

.8 Do di-electric tests, hi pot tests in the factory and, insulation resistance tests and ground continuity tests as required by the nature of the various systems and equipment on site.

.9 With the systems completely connected and lamped, the following tests shall be made:

.1 Control and Switching: Test all circuits for the correct operation of devices, switches and controls.

.2 Polarity Tests: Test all circuits for the correct operation of devices, switches and controls.

.3 Voltage Tests: Make a voltage test at the last outlet of each circuit. The maximum drop in potential permitted will be 3% on 120 V, 208 V and 600 V branch circuits, 2% on 208 V and 600 V feeder circuits and 2% on feeder circuits serving Motor Control Centres. Correct any deficiency in this regard.

.4 Phase Balance: Measure the load on each phases at each switchboard, splitter, distribution panel, lighting panel and power panel and report the results in writing to the Departmental Representative. Rearrange phase connections as necessary to balance the load on each phase as instructed by the Departmental Representative, with the arrangement being restricted to the exchanging of connections at the distribution points mentioned in this paragraph. After making any such changes, update the record drawings and as-built drawings to show the modified connections.

.5 Supply Voltage: Measure the line voltage of each phase at the load terminals of the main breakers and report the results in writing to the Departmental Representative. This test shall be carried out with the majority of electrical equipment in use.

.6 Motor Loading: Measure the line current of each phase of each motor with the motor operating under load and report the results in writing to the Departmental Representative. Upon indication of any imbalance or overload, thoroughly examine the electrical connections and rectify any defective parts or wiring. If

electrical connections are correct, overloads due to defects in the driven machines shall be reported in writing to the Departmental Representative.

.7 General Operations: Energize and put into operation each and every electrical circuit and item. Make repairs, alterations, replacements, tests and adjustments necessary for a complete and satisfactory operating electrical systems.

.10 Test all systems and obtain written confirmation from the manufacturer of each system that all components have been installed correctly and that the system is functioning properly. Present separate certification for all systems: fire alarm, power distribution, IPC units, etc., to the Departmental Representative.

.11 Provide labour, instruments, apparatus and pay all expenses required for the tests. The Departmental Representative reserves the right to demand proof of the accuracy of all instruments used.

.12 When the tests are performed, the Departmental Representative may require that equipment, outlets, devices, etc., be opened and/or removed from their housings and/or outlet boxes in order that the interior of the equipment and wiring terminations and connections may be examined. Provide all labour and tools for this purpose.

.13 The testing of motors shall be coordinated with the trades providing the equipment driven by the motors so that they are carried out at the time the driven equipment is put on test. In addition to the tests called for in motor loading above, provide labour and instruments to take and record all motor load readings required to supplement the tests on the driven equipment through various load sequences, as required by the trades involved.

.14 Surge Protection Device (SPD)

.1 Formally known as a Transient voltage Surge Suppression (TVSS)

.2 Conduct visual and Mechanical Review.

.1 As per Section 26 43 13.

.3 Complete the following Electrical Testing:

.1 As per Section 26 43 13.

.15 Emergency Lighting

.1 Conduct Visual and Mechanical Review:

.1 As per CSA C22.1 No.141.

.2 Complete the following Electrical Testing:

.1 As Per CSA C22.1 No. 141.

1.8 BUILDING TURN OVER

.1 Provide labour, material, tools, etc., required to building turn over the electrical systems in the presence of the Departmental Representative and the Owner.

.2 Operate all systems and demonstrate how they conform to specifications. Under supervision, make adjustments and fine tune systems.

1.9 CARE, OPERATION, START-UP AND TRAINING OF OWNER'S PERSONNEL

.1 Instruct operating personnel in operation, care and maintenance of equipment.

.2 Arrange and pay for services of manufacturer's factory service representative to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with aspects of its care and operation.

1.10 SINGLE LINE ELECTRICAL DIAGRAMS

.1 Provide single line diagrams in glazed frame of the Electrical distribution system. Locate in main Electrical Room and all other electrical rooms. The single line diagram shall be an up to date drawing of the new system distribution.

1.11 TRAINING OF OWNER PERSONNEL

.1 Trade Contractor

.1 The trade contractor shall have the following training responsibilities:

.1 Provide the Departmental Representative with a training plan two weeks before the planned training according to the outline described in Section 01 91 41 – Commissioning – Training.

.2 Provide designated Owner Representative with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical equipment or system.

.3 Training shall start with classroom sessions, if necessary, followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including start-up, shutdown, fire / smoke alarm, power failure, etc.

.4 During any demonstration, should the system fail to perform in accordance with the requirements of the O&M Manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

.5 The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing trade contractor or manufacturer's representative. Practical building operating expertise, as well as in-depth knowledge of all modes of operation of the specific piece of equipment, is required.

.6 The training sessions shall follow the outline in the Table of Contents of the O&M Manual and illustrate wherever possible the use of the O&M Manual or reference.

.7 Training shall include:

.1 Use the printed installation, operation and maintenance instruction material included in the O&M Manuals.

.2 Include a review of the written O&M manual instructions, emphasizing safe and proper operation requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.

.3 Discuss relevant health and safety issues and concerns.

.4 Discuss warranties and guarantees.

.5 Cover common troubleshooting problems and solutions.

.6 Explain information included in the O&M manuals and the location of all plans and manuals in the facility.

.7 Discuss any peculiarities of equipment installation or operation.

.8 Classroom sessions shall include the use of overhead projections, slides, and video and audio taped materials as might be appropriate.

.8 Hands-on training shall include start-up; operation in all modes possible, including manual; shutdown; and any emergency procedures and maintenance of all pieces of equipment.

.9 The trade contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.

.10 Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.

.11 Duration of Training:

.1 The trade contractor shall provide training on each piece of equipment.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

26 05 20 WIRE AND BOX CONNECTORS (0 – 1,000 V)

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for wire and box connectors under 1,000V.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CAN/CSA-C22.1 (current edition), Canadian Electrical Code, Part 1.

.2 CAN/CSA-22.2 No. 18 (current edition), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.3 CSA C22.2 No. 65 (current edition), Wire Connectors.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC):

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1,200 Ampere Maximum Rating).

.3 National Electrical Manufacturer's Association (NEMA).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 MATERIAL

.1 Pressure type wire connectors shall be in accordance with CSA C22.2 No. 65, with current carrying parts of copper and aluminum sized to fit copper and aluminum conductors as required.

.2 Fixture type splicing connectors to shall be in accordance with CSA C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing Stud Connectors shall be NEMA to consist of:

- .1 Connector body and stud clamp for stranded copper and aluminum conductors.
- .2 Clamp for stranded copper conductors.
- .3 Clamp for stranded aluminum conductors.
- .4 Stud clamp bolts.
- .5 Bolts for copper conductors.
- .6 Bolts for aluminum conductors.
- .7 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, non-metallic sheathed cable as required shall be in accordance with CAN/CSA-C22.2 No. 18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with EEMAC 1Y-2, NEMA.

3.2 MAINTENANCE – CLEARANCES

.1 Provided clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 05 21.01 WIRE AND CABLES (0 – 1,000 V)

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for wires and cables rated under 1,000V.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1 (current edition), Canadian Electric Code, Part 1.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS – Material Safety Data Sheets in accordance Section 02 81 01 – Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors shall be stranded for 8 AWG and larger. Minimum size shall be 12 AWG.

.2 Copper and aluminum conductors shall be sized as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, unjacketed.

.3 Copper conductors shall be sized as indicated with thermoplastic insulation type TWU rated at 600 V.

2.2 TECK 90 CABLE

.1 Cable shall be in accordance with Section 26 05 00 – Common work results for Electrical.

.2 Conductors:

.1 Grounding conductor shall be copper as indicated.

.2 Circuit conductors shall be copper as indicated, size as indicated.

.3 Insultation:

.1 Ethylene propylene rubber EP.

.2 Cross-linked polyethylene XLPE.

.3 Rating shall be 600 V.

.4 Inner jacket shall be polyvinyl chloride material.

.5 Overall covering shall be thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.6 Fastenings:

.1 One-hole steel straps to secure surface cables 50 mm and smaller.

.2 Channel type supports for two or more cables.

.3 Threaded rods shall be 6 mm diameter to support suspended channels.

.7 Connectors

.1 Watertight, or explosion-proof as required approved for Teck cable.

2.3 ARMOURED CABLES

.1 Conductors shall be insulated, copper or aluminum, size as indicated.

.2 Type shall be AC90.

.3 Armour shall be interlocking type fabricated from aluminum strip.

.4 Type shall be ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.

.5 Connectors shall be anti-short connectors.

2.4 CONTROLS CABLES

.1 Type shall be LVT with two soft annealed copper conductors, sized as indicated.

.1 Insulation shall be thermoplastic.

.2 Sheath shall be thermoplastic jacket.

.2 Type shall be low energy 300 V control cable with stranded annealed copper conductors sized as indicated LVT with two soft annealed copper conductors, sized as indicated:

.1 Insulation shall be TW.

.2 Overall covering shall be polyethylene jackets.

.3 Type shall be 600 V stranded annealed copper conductors; sizes as indicated:

.1 Insulation shall be RW90 (x-link).

.2 Overall covering shall be thermoplastic jacket with sheath of aluminum interlocked armour and jacket over sheath of PVC.

2.5 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type shall be NMD90XLPE, size as indicated.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and Ducts.

.2 Terminate cables in accordance with 26 05 20 – Wire and Box Connectors – (0 – 1,000V).

.3 Cable Colour Coding shall be in accordance with Section 26 05 00 – Common Work Results for Electrical.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of Feeder Cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls shall be typical drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be two-wire circuits only, i.e. common neutrals not permitted.

.8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.2 INSTALLATION FOR BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.2 In underground ducts in accordance with Section 33.

.3 In surface and lighting fixture raceways in accordance with Section 26.

.4 In wireways and auxiliary gutters in accordance with Section 21.

3.3 INSTALLATION OF TECK 90 CABLE (0 – 1,000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely support by straps and hangers.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit and underground ducts.

.2 Ground control cable shield.

3.6 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

END OF SECTION

26 05 31 SPLITTERS, JUNCTION BOXES AND CABINETS

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for splitters, junctions, pull boxes, and cabinets.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1, 20th Edition.

.2 CSA C22.2 No. 76, Splitters.

.3 CSA C22.2 No. 40, (Cutout), Junction and pull boxes.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provided manufacturer's printed product literature, specifications and datasheet and include project characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS – Material Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and Include: Project characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Construction-welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat covers.

2.3 CABINETS

.1 Construction: welded sheet steel hinged door, handle, latch and catch.

.2 Type E Empty: flush overlapping sides, mounting as indicated.

.3 Type T Terminal: flush overlapping sides mounting as indicated containing 19 mm plywood backboard.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Identification Labels: size 2 indicating system name, voltage and phase, or as indicated.

3.4 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 05 32 OUTLET BOXES, CONDUIT BOXES AND FITTINGS

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for outlet boxes, conduit boxes and fittings.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1, 20th Edition.

.2 CSA C22.2 No. 18, Outlet Boxes, conduit boxes and fittings.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed project literature, specifications and data sheets, and include product characteristics, performance criteria, physical sizes, finish and limitations.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES – GENERAL

.1 Size boxes in accordance with CSA C22.1

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished walls.

2.3 CONDUIT BOXES

.1 Cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.5 FITTINGS – GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.6 SERVICE FITTINGS

.1 ‘High Tension’ receptacles fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for two duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.

.2 Pedestal type ‘low tension’ fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate two amphenol jack connectors.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion or work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

3.2 MAINTENANCE

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completed and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 05 34 CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for conduits, conduit fastenings, and conduit fittings.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standard Association (CSA International)

.1 CAN/CSA C22.2 No. 18 (current edition), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45 (current edition), Rigid Metal Conduit.

.3 CSA C22.2 No. 56 (current edition), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83 (current edition), Electric Metallic Tubing

.5 CSA C22.2 No. 211.2 (current edition), Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3 (current edition), Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS – Material Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only on continuous cable without splices.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

.1 One-hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Use electrical metallic tubing (EMT) except in cast concrete.

.4 Use rigid PVC conduit underground.

.5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.6 Use explosion proof flexible connection for connection to explosion proof motors.

.7 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.8 Minimum conduit size for lighting and power circuits: 19 mm.

.9 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1 / 10th of its original diameter.

.10 Mechanically bend steel conduit over 19 mm diameter.

.11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.12 Install fish cord in empty conduits.

.13 Run two 25 mm spare conduits up to ceiling space and two 25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.

.14 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.15 Dry conduits out before installing wire.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 SURFACE CONDUITS

.1 Surface conduits shall only be installed in mechanical and electrical rooms.

.2 Run parallel or perpendicular to building lines.

.3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.4 Run conduits in flanged portion of structural steel.

.5 Group conduits wherever possible on suspended channels.

.6 Do not pass conduits through structural members except as indicated.

.7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre on third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

3.8 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 05 43.01 INSTALLATION OF CABLES IN TRENCHES AND DUCTS

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for cables in trenches and in ducts and in-grade junction boxes.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International).

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1.

.2 Insulated Cable Departmental Representatives Association, Inc. (ICEA).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment for Underground Conduits for the Alarm System will be on a linear metre basis, in accordance with the Contract Document or as directed by the Departmental Representative.

.1 Payment shall be made under **"Underground Conduits (Alarm Systems)"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Measure for payment for In-Grade Junction Boxes will be on a per unit basis, in accordance with the Contract Document or as directed by the Departmental Representative.

.1 Payment shall be made under **"In-Grade Junction Boxes (Alarm System)"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Measure for payment for all site electrical distribution Works other than as included in **"Underground Conduits (Alarm Systems)"** , and **"In-Grade Junction Boxes (Alarm System)"** under **"Site Electrical Works excl. items included elsewhere and Building Electrical"** will be on a Lump Sum basis, in accordance with the Contract Document or as directed by the Departmental Representative.

.1 Payment shall be made under **"Site Electrical Works excl. items included elsewhere and Building Electrical** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Generally, but without limitation, the site electrical distribution Works included within this Lump Sum item are as detailed within Drawings under the NORR seal other than as include within the buildings.

.4 Items considered incidental to the Work include, but are not limited to:

.1 Protective planks.

.2 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.5 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

.6 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"** and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS – Material Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Sample:

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.4 Quality Assurance:

.1 Submit site tests results of installed electrical systems and instrumentation.

.5 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 CABLE PROTECTION

.1 38 mm x 140mm planks to be cedar or douglas fir.

2.2 IN GRADE JUNCTION BOXES

.1 Junction boxes to be plastic H20 rated and come with ductile iron lid.

.1 Ductile iron lid to be grounded.

.2 Acceptable Manufacturer – Valmont Structures or engineer approved equal.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

.1 After sand bed specified in Section 31 23 33.01 – Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices are not acceptable.

.4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, eight times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm horizontal separation between low and high voltage cables.

.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.

.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

.5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.

.6 Install protected planks on lower cables 0.6 m in each direction at crossings.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated inside ducts.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.

.5 Before pulling cables into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-Acceptance Tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1,000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 Leakage Current Testing:

.1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.

.4 Hold maximum voltage for specified time period by manufacturer.

.5 Record leakage current at each step.

.7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.4 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 05 80 FRACTIONAL HORSEPOWER MOTORS

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for fractional horsepower motors.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1

.2 CSA C22.2 No. 100-04, Motors and Generators.

.3 CSA C22.2 No. 145 M1986(R2004), Motors and Generators for Use in Hazardous Locations.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit WHMIS MSDS – Material Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and include product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional Departmental Representative registered or licensed in Province of Alberta, Canada.

.2 Indicate dimensions, recommended installation procedure, wiring diagrams, sizes and location of mounting bolt holes and recommended support method.

.4 Quality Assurance Submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturer’s Instructions:

.1 Submit manufacturer’s installation instructions.

.6 Closeout Submittals:

.1 Provide maintenance data for fractional horsepower motors for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 FRACTIONAL HORSEPOWER MOTOR

.1 Non-hazardous locations shall be in accordance with CSA C22.2 No.100.

.2 Hazardous locations shall be in accordance with CSA C22.2 No.145.

.3 Motor with inherent overheating protectors.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install wiring, flexible connections and grounding.

.2 Check rotation before coupling to driven equipment.

3.3 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 27 16 ELECTRICAL CABINETS AND ENCLOSURES

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for electrical cabinets and enclosures.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1.

.2 CAN/CSA C22.2 No. 94.1-07, Enclosures for Electrical Equipment, Non Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA):

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

.3 The Munsel System of Colour Notation.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment for the Reservoir Sea-Can Electrical will be paid on a lump sum basis, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Water Treatment Plant: Electrical**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Items considered incidental to the Work include, but are not limited to:

.1 All required luminaires, receptacles, and lighting control devices required for the complete sea-can electrical as per the design documents.

.2 All required wiring, cables, connectors, and conduits required for the interconnection of all electrical equipment within the reservoir sea-can as per the design documents.

.3 All required enclosures, control devices, power supplies, and relays for the completion of an operational reservoir control panel as outlined in the design documents.

.4 All required panelboards, disconnects, breakers and other power distribution equipment required as per the design document for installation within the reservoir sea-can. This excludes all power distribution equipment for supplying power to the sea-can as outlined in Section 26 34 33 Photovoltaic Power System.

.4 Traffic Control required for this Work shall be incidental to "**Traffic Accommodation**" and no separate payment will be made to the Contractor

.5 Mobilization and demobilization required for this Work shall be incidental to "**Mobilization / Demobilization**" and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS – Materials Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: Submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

.3 Data necessary for maintenance of materials.

.4 Manufacturers recommended list of spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

.5 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.6 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CAN/CSA C22.2, Munsell Notation 7.5GY3.5 / 1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN / m area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Cover shall be tamperproof, bolt-on, domed to shed water.

.5 Door shall be three-point latching, with padlocking means.

.6 Ventilation panel constructed to allow air calculation yet preventing entry of foreign objects, wildlife, and vermin.

Part 3 Execution

3.1 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00 – Common Work Results for Electrical.

3.2 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in present of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.3 MAINTENANCE - CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.4 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 11 – Cleaning.

.2 Leave work area clean at end of each day.

.3 Final Cleaning: Completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.4 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 27 26 WIRING DEVICES

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for wiring devices.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1.

.2 CSA C22.2 No. 42 (current edition), General Use Receptacles, Attachment Plugs and Similar Devices.

.3 CAN/CSA C22.2 No. 42.1 (current edition), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.4 CSA C22.2 No.55 (current edition), Special Use Switches.

.5 CSA C22.2 No.111 (current edition), General-Use Snap Switches (Bi-National Standard, with UL 20).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide manufacturer's printed product literature specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS – Materials Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Sample:

.1 Submit samples in accordance with 01 33 00 – Submittal Procedures.

.4 Quality Assurance:

.1 Submit site tests results of installed electrical system and instrumentation.

.5 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 – Closeout Submittals

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, and three-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No.10 AWG wire.

.2 Silver allow contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.3 Toggle-operated, fully rated for LED, tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads and or heating loads.

.4 Switches of one manufacturer throughout project.

.5 Provide specification-grade switches.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 5-20 R, 125 V, 15 A or 15 / 20 A, U ground, to: CSA C22.2 No.42 with following features:

.1 White urea moulded housing.

.2 Suitable for No.10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Four side wiring screws. Back wiring is not permitted.

.5 Triple wipe contacts and riveted grounding contacts.

.2 Ground fault Interrupter type to be 15 A or 15 / 20 A, 125 V duplex receptacles to be 2-pole, 3-wire specification grade, white face, parallel blade, U ground, impact resistant, nylon face complete with breaker and reset button.

.3 All other single outlet and special purpose receptacles are to be similar to the specification grade. Confirm ampacity, voltage and pin configuration prior to installation.

.4 Receptacles on one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

.1 Pilot light as indicated, with neon type 0.04 W, 125 V lamp and red plastic lens flush type.

.2 Combination Occupancy Sensors Wall Switches (Line Voltage):

.1 Line voltage wall switch sensors shall be capable of detecting presence in the floor area to be controlled by detecting shifts in passive infrared and ultrasonic sensors.

.2 Provide neutral wire at each switch position.

.3 Sensors shall be complete with the following:

.1 Override push switch.

.2 LED detection status indicator.

.3 Low profile recessed designs to suit “Decorator Plate”.

.4 Dual level lens to enhance detection at desktop level.

.5 Ability to maintain luminaires on operation when occupancy is only one person sitting at a desk in accordance with NEMA WD7 guidelines.

.6 Temperature and humidity resistance.

.7 Time delay range from 30 seconds to 30 minutes.

.8 Sensitivity adjustment from 20% to 100%.

.9 Compatible with electronic ballasts and LED drivers.

.10 Immunity to FRI and EMI interference.

.11 Integrated light level sensor optional holds light off when the natural light is above the preset levels.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel cover plates, thickness 0.8 mm for wiring devices mounted in flush-mounted outlet box.

.4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated. Weatherproof single-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 16010 (26 05 00) – Common Work Results.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 16010 (26 05 00) – Common Work Results.

.3 Where split receptacle has one position switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlets boxes on surface-mounted boxes.

3.2 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

3.4 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 28 16.02 MOLDED FAULT EQUIPMENT PROTECTION

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 CSA-C22.2 NO.5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, 10th edition, and the second edition of NMX-J-266-ANCE).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Include time-current characteristic curves for breakers with ampacity of 200 A and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit Breakers and Ground-fault circuit-interrupters to CSA C22.2 No.5.

.2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation.

.3 Common-trip breakers with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers adjustable trips to range from three to eight times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 10 kA symmetrical RMS interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Under-voltage release.

.4 On-off locking device.

.5 Handle mechanism.

2.4 ENCLOSURE

.1 Minimum NEMA 1 rated enclosure for individually mounted breakers

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 28 23 DISCONNECT SWITCHES – FUSED AND NON-FUSED

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for fused and non-fused disconnect switches.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 CAN/CSA C22.2 No.4 (current edition), Enclosed Switches.

.2 CSA C22.2 No.39 (current edition), Fuseholder Assemblies.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS – Material Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Sample:

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.4 Quality Assurance:

.1 Submit site tests results of installed electrical systems and instrumentation.

.5 Closeout Submittals

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 size as indicated.

.2 Provision for padlocking in off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

3.2 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 29 03 CONTROL DEVICES

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for control devices.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2000(R2008), Industrial Control Systems: General Requirements

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for control devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional Departmental Representative registered or licensed in Province of Alberta, Canada.

.2 Include schematic, wiring, interconnection diagrams.

.4 Quality Assurance

.1 Conduct tests in accordance with Section 26 05 00 – Closeout Submittals.

.5 Closeout Submittals

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: Submit operation and maintenance data for control devices for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect control devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 To CSA C22.2 No.14 and NEMA ICS 1.

.2 Convertible Contact Type: Contacts field convertible from NO to NC, electrically held. Coil rating: as indicated. Contact rating: as indicated, Number of Poles: as indicated.

.3 Sealed Contact Type: Electrically held. Coil rating: as indicated. Contact Rating: as indicated, Number of Poles: as indicated.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: Normally-open – convertible to normally-closed in field.

2.3 SOLID STATE TIMING RELAYS

.1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact.

.2 Operation: On-delay or off-delay as indicated.

.3 Potentiometer: External to provide time interval adjustment.

.4 Supply Voltage: 120 V, AC, 60 Hz.

.5 Temperature Range: -10C to +55C.

.6 Output Contact Rating: Maximum voltage 250 V AC . Current: 5 A.

.7 Timing Ranges: Minimum 0.5 s, maximum 10hr.

2.4 OPERATING CONTROL STATIONS

.1 Enclosure: CSA Type 3R, surface mounting

2.5 PUSHBUTTONS

.1 Illuminated or standard NEMA 3R rated. Operator flush type, as indicated. Black, with NO and NC contacts as indicated, labels as indicated. Stop pushbuttons coloured red, provision for padlocking in depressed position labelled "emergency stop".

2.6 SELECTOR SWITCHES

.1 Maintained or spring return, two or three position as required. Labelled as indicated, NEMA 3R rated minimum, standard operators, contact arrangement as indicated.

2.7 INDICATING LIGHTS

.1 Standard duty, NEMA 3R rated minimum, full voltage, LED type, lens colour: as indicated, supply voltage: as indicated, labels as indicated.

2.8 CONTROL AND RELAY PANELS

.1 CSA Type 3R sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.9 THERMOSTAT (LINE VOLTAGE)

.1 Wall mounted, for exhaust fan control.

.2 Full load rating: 8 A at 120 V AC.

.3 Temperature setting range: 0 C to 30 C.

.4 Thermometer Range: -20 C to 40 C.

.5 Markings in 5 degrees increments.

.6 Reverse acting for control of exhaust fan

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for control devices installation in accordance with manufacturer's written instructions.

.2 Visually inspect substrate in present of Departmental Representative.

.3 Inform Departmental Representative of unacceptable conditions immediately upon discovery. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install control and relay panels, control devices and interconnect.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Depending on magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by fire pump control installation.

3.5 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.6 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 11 – Cleaning.

.2 Leave work area clean at end of each day.

.3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning

END OF SECTION

26 29 10 MOTOR STARTERS TO 600V

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for motor starters under 600V.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1.

.2 International Electrotechnical Commission (IEC)

.1 IEC 947-4-12002, Part 4: Electromechanical contactors and motor-starters.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS – Material Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Provide shop drawings for each type of starter to indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout and Components.

.4 Enclosure types.

.5 Wiring diagram.

.6 Interconnection diagrams.

.4 Closeout submittals

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Data necessary for maintenance materials.

.3 Manufacturers recommended list of spare parts.

.4 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

1.6 EXTRA MATERIALS

.1 Provide listed spare parts for each different size and type of starter.

.1 three contacts, stationary.

.2 three contacts, movable.

.3 one contacts, auxiliary.

.4 one control transformer.

.5 one operating coil.

.6 two fuses.

.7 10 % indicating lamp bulbs used.

1.7 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 MATERIALS

.1 Starters: to IEC 947-4 with AC4 utilization category.

2.2 MANUAL MOTOR STARTERS

.1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One overload heater, manual and auto reset functionality, trip indicating handle.

.2 Accessories

.1 Selector Switch: Standard DutyNEMA 3R labelled as indicated.

.2 Indicating Light: Standard DutyNEMA 3R type and colour as indicated.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Accessories

.1 Pushbuttons and Selector Switches: Standard Duty, NEMA 3R labelled as indicated.

.2 Indicating Lights: Standard Duty, NEMA 3R type and colour as indicated.

.3 1-N / O and 1-N / C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 ACCESSORIES

.1 Pushbutton: Standard duty, NEMA 3R as required.

.2 Selector Switches: Standard duty, NEMA 3R as required.

.3 Indicating Lights: Standard duty, NEMA 3R, type and colour as indicated.

2.6 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 – Common Work Results for Electrical.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnet starter designation label, white plate, black letters, size 1 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

3.2 FIELD QUALITY CONTROL

.1 Perform test in accordance with Section 26 05 00 – Common Work Results for Electrical and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operated as indicated.

3.3 MAINTENANCE – CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning.

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

.3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 43 13 SURGE PROTECTION DEVICE (SPD)

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirements for surge protection devices.

.2 As required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1.

.2 The specified unit shall be designed, manufacturer, tested and installed in accordance with the following standards:

.1 American National Standards Institute of Electrical and Electronic Departmental Representative (ANSI / IEEE C62.41-latest and C62.45-latest).

.2 Canadian Standards Association (CSA) CSA C22.2-Lastest Edition.

.3 Federal Information Processing Standards Publication 94 (FIPS PUB 94)

.4 National Fire Protection Association (NFPA 75 and 78).

.5 Underwriters Laboratories (UL 1449, UL 1283).

.6 Ontario Hydro Electrical Safety Code Latest Edition.

.7 NEMA LS-1.

.8 ANSI / IEEE C62.41.1 – IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits.

.9 ANSI / IEEE C62.41.2 – IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000 V and under) AC Power Circuits.

.10 ANSI / IEEE C62.45 – IEEE Guide for Surge Testing on Equipment in Low Voltage AC Power Circuits.

.11 FIPS Pub 94 (current edition) – USDC Guide for Installation Techniques on Electrical Power Environments.

.12 NEMA LS-1 Guidebook for the Specification of Surge Protection Devices.

.13 (RoHS) Restriction of Hazardous Substances Directive: All SPDs shall be compliant with the Restriction of Hazardous Substances Directive 2002 / 95 / EC.4.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Product data shall be submitted in accordance with Section 26 05 00 – Common Work Results for Electrical. This shall include schematic diagram and all options including indicating lights and dry contact.

.2 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS – Material Safety Data Sheets in accordance with Section 02 81 01 – Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Evidence of compliance to the certifications as per CSA and UL 1449 must be This will show actual test data as certified by UL and ANSI standard. Document to include copy of UL Listing Report. Manufacturer shall certify stating that test tests and delivered product both had same suppliers for raw materials and same to manufacture.

.4 The following information shall be made available to the Specifying Departmental Representative:

.1 Verification of the SPD Systems' compliance with the required ANSI / UL 1449, 3rd Edition Listing by Underwriter's Laboratories (UL) or other valid, Nationally Recognized Testing Laboratory (NRTL) such as "c ETL us Listed", "c UL us Listed", "c CSA as Listed", "Itertek / ETL LISTED", for Departmental Representative review and approval.

.2 Manufacturer's electrical specifications and/or mechanical drawings indicating unit dimensions, weights, full installation instructions, and wiring configuration details.

.3 Compliance data, including Agency Listing or Agency Control Identification Number, Manufacturer's Model Numbers, SPD Type, System Voltage Type, Wiring Diagrams, Voltage Protection Ratings, applicable Technical Specification and/or Mechanical Drawings, and Installation Sheets.

.5 Sample:

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.6 Quality Assurance:

.1 Submit site tests results of installed electrical systems and instrumentation.

.7 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure.

1.7 DESCRIPTION OF SYSTEM

.1 Formally known as Transient Voltage Surge Suppression (TVSS) and now known as Surge Protection Device (SPD).

.2 Surge Suppression Device (SPD) shall consist of a high performance designed to provide surge protection and high-frequency electrical noise filtering.

.3 The specified unit shall be compatible with non-linear loads and provide hi transient voltage suppression, surge current diversion and high-frequency electrical noise attenuation.

.4 The unit shall be connected in parallel with the electrical distribution system.

.5 The operation of the unit shall not be affected by or interact with any other reduction device installed on the electrical distribution system.

.6 SPD unit shall be connected to the equipment via a circuit breaker from within the equipment. The SPD shall be of modular design.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.9 QUALIFIED MANUFACTURERS

.1 Total Protection Solutions model TK-TT2-065-1S240-FL-M or engineer approved equal.

1.10 WARRANTY

.1 Equipment manufacturer shall warrant that all SPD products supplied are fully performance and safety tested and are free of operational and material defects in workmanship and performance for 25 years.

Part 2 Products

2.1 GENERAL

.1 The SPD device shall be suited for operation in the following configuration 120 / 240VAC, electrical configuration. Operating temperature range shall be -40 to +70C.

.2 Operation shall be reliable in an environment with 5% to 95% non-condensing humidity.

.3 The unit shall not generate any audible noise during normal operation.

.4 No appreciable magnetic fields shall be generated by the SPD. The unit shall be used directly in Computer Rooms and any location without danger to storage systems or devices.

.5 Safe, Five-Mode Surge-Path Protection: SPD technology shall employ full five-mode protection paths to protect all L-L, L-N, L-G and N-G.

.6 Response time shall be less than 1 nanosecond

.7 Dedicated Disconnect Breaker for Power Panel Installation: Where "most effective SPD performance" placement of SPD for "load-side" placement / connection is desired, the SPD shall be "close-coupled" to a dedicated circuit breaker or disconnect within the power panel or switchgear. However, if the SPD is located as a "Type 1, line-side SPD", no breaker or disconnect is required where the desired SPD or connection point is directly into the primary level Main Distribution Panel, Motor Control Centre or Main Switchgear.

2.2 ENCLOSURES

.1 Acceptable enclosures shall be rated under enclosure type NEMA 4 and/or NEMA 4X (see NEMA Enclosure Ratings).

2.3 FEATURES

.1 Internal Connections: All surge current diversion connections shall be a by with impedance wiring. No circuit boards shall be used in transient energy paths.

.2 SPD / Filter system connections. No plug-in component modules, quick-disconnect terminals or printed circuit board shall be used in surge current carrying paths.

.3 Unit Status indicators: Red status indicator LEDS shall be provided on the cover to indicate the protection status on all phases.

Part 3 Execution

3.1 INSTALLATION

.1 The SPD should be installed following the manufacturer's recommended practices and in compliance with all applicable codes.

3.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification nameplate.

3.3 FIELD TESTING

.1 Provide complete verification per manufacturer instruction including suggested values on bolted connections.

.2 Ensure satisfactory performance to stated standards and if any module or un comply replace it completely.

.3 Record insulation resistance from phase to ground according to manufacturer or industry standard. Provide formal records to Departmental Representative for review.

3.4 MAINTENANCE – CLEARANCES

.1 Provide clearances around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

26 50 00 LIGHTING

Part 1 General

1.1 DESCRIPTION

.1 This section includes materials and installation requirement for lighting, other than those listed in the Contract Documents.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 NSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast

.2 American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI / IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

.3 ASTM International Inc.

.1 ASTM F1137-00 (2006), Standard Specification for Phosphate / Oil and Phosphate / Organic Corrosion Protective Coatings for Fasteners.

.4 Canadian Standards Association (CSA International)

.1 CSA C22.1 (current edition), Canadian Electrical Code, Part 1.

.5 ICES-005-07, Radio Frequency Lighting Devices.

.6 Underwriters' Laboratories of Canada (ULC).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 This work shall be incidental to the Contract and will not be measured for payment.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 – Quality Control

1.5 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's instructions, printed product literature, specifications and datasheets for and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Engineer.

.3 Samples:

.1 Submit samples as required in accordance with Section 01 33 00 – Submittal Procedures.

.4 Quality assurance submittals: provide following in accordance with Section 01 45 00 – Quality Control.

.1 Manufacturer's instructions: provide manufacture's written installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.5 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers list of recommended spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Products

2.1 LAMPS

.1 All LED chips to be integral to the luminaire.

2.2 BALLASTS

.1 LED Driver:

.1 Rating: 120 V, 60 Hz

.2 Suitable for 40C ambient temperature

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listing(s) and CSA certification(s) related to intended installation.

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated

.2 Provide adequate support to suit ceiling system

3.2 WIRING

.1 Connect luminaires as indicated

.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.4 MAINTENANCE - CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, review, servicing, maintenance and as recommended by manufacturer and CEC, Part 1.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning.

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

31 05 10 CORRECTED DRY DENSITY FOR FILL

Part 1 General

1.1 DESCRIPTION

.1 This Section defines correction to maximum dry density to take into account aggregate particles larger than 19mm.

1.2 REFERENCES

.1 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.

.2 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbr/ft3 (600 kN-m / m3)).

.3 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbr/ft3 (2,700 kN-m / m3)).

.4 ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 DEFINITIONS

.1 Corrected maximum dry density is defined as:

.1 D =(D1xD2) / ((F1 x D2) + (F2 x D1)).

.2 D = (F1 x D1) + (0.9 x D2 x F2).

.3 Where: D = corrected maximum dry density kg/m3.

.4 F1 = fraction (decimal) of total field sample passing 19mm sieve.

.5 F2 = fraction (decimal) of total field sample retained on 19mm sieve (equal to 1.00 - F1).

.6 D1 = maximum dry density, kg/m3 of material passing 19mm sieve determined in accordance with Method A of ASTM D1557.

.7 D2 = bulk density, kg/m3, of material retained on 19mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.

.2 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253 wet method when directed by Departmental Representative.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

31 05 16 AGGREGATE PRODUCTION

Part 1 General

1.1 DESCRIPTION

.1 Screening of native excavation extracted from work areas to produce suitable aggregate meeting the gradation of AT Des 6 Class 80 aggregate, as per the Contract Documents or as directed by the Departmental Representative.

.2 Prior to any aggregate production, the Contractor must provide a Work Plan, in accordance with Section 01 33 00 – Submittal Procedures, detailing the intended methods of producing the AT Des 6 Class 80 aggregate. Aggregates produced prior to acceptance of the Work Plan may not be accepted.

.3 Should the sieve analysis of native material indicate other gradations can be met through screening only, the Departmental Representative may request the production of other aggregate clauses to be incorporated in the Work.

1.2 REFERENCES

.1 AT - Standard Specifications for Highway Construction (latest edition).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Production of AT Des 6 Class 80 aggregate shall be incidental to "**AT Designation 6 Class 80 Gravel Fill (Granular Pathway)"** and no additional payment will be made.

.2 Items considered incidental to the Work include, but are not limited to:

.1 All operations involved in Screening, including retrieving from temporary stockpiles as necessary.

.2 Loading, hauling and stockpiling of aggregates.

.3 Dust control and testing.

.4 Clean-up of work area and stockpile waste.

.5 Survey.

.6 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.3 The surface to surface prismoidal method will be used in calculating surveyed stockpiled quantities.

.4 Additional aggregate material produced, (waste or otherwise) shall not be measured for payment.

.5 Traffic Control when required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

.6 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"** and no additional payment will be made.

1.4 SUBMITTALS

.1 In accordance with Section 01 33 00 Submittal Procedures.

1.5 QUALITY CONTROL

.1 In accordance with Section 01 45 00 – Quality Control.

.2 Prior to using aggregate in the Works, the Contractor must provide aggregate testing results to the Departmental Representative for acceptance.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 – Environmental Procedures.

Part 2 Products

2.1 MATERIALS

.1 AT Des 6 Class 80 Aggregate shall be in accordance with Section 3.2 of AT - Standard Specifications for Highway Construction (latest edition).

Part 3 Execution

3.1 STOCKPILING

.1 Aggregates are to be stockpiled within the Contractor's worksite or as directed by the Departmental Representative.

.2 All aggregate materials to be stockpiled in accordance with AT - Standard Specifications for Highway Construction Section 3, Specification 3.2 – Aggregate Production and Stockpiling (latest edition).

.3 No stockpiling by conveyor shall be permitted.

.4 Stockpile sites shall be prepared depending on the existing and final ground cover proposed.

.1 Stockpiles or portions thereof, that are on vegetated areas that are to remain vegetated shall be protected by rig matting prior to the stockpile material being deposited.

.2 Areas to be hardscaped upon completion of construction and removal of the stockpile shall be cleared of all vegetation, trees, brush, and other debris and have a uniform gravel surface prepared prior to the stockpile material being deposited.

.5 Stockpiles shall be constructed on the designated site and when completed shall be neat and regular in shape, occupying as small an area s is practicable. Spilling of material over the edges of the piles will not be permitted.

.6 The Contractor shall ensure that stockpiles shall be built up in layers not to exceed 1m in thickness.

.7 No stockpile shall have side slopes steeper than 1.5H:1V. Side slopes and Pit faces shall meet WCB requirements for Alberta.

.8 Contractor is advised that it is their responsibility to allow for compaction shrinkage, of crushed materials, when placed in stockpiles and no allowance by Departmental Representative is calculated in survey quantity stockpile calculations for this shrinkage.

END OF SECTION

31 11 00 CLEARING AND GRUBBING

Part 1 General

1.1 DESCRIPTION

.1 Grubbing and disposing of woody debris as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

.2 Clearing as directed by the Departmental Representative.

1.2 REFERENCES

.1 AT - Standard Specifications for Highway Construction (latest edition).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment for grubbing will be the areas in horizontal (2D) hectares of grubbing that has been acceptably completed in accordance with the Contract Documents and will, unless otherwise specified, be measured from the edge of the existing hard surfacing of either gravel, concrete or pavement to 1m past the grading limit line as shown approximately on the IFC Drawings or as directed by the Departmental Representative.

.1 Payment will be made under **"Grubbing"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Items considered incidental to the Work include, but are not limited to:

.1 Loading, hauling and disposal of grubbing waste.

.2 Overhaul.

.3 Bird surveys must be completed and current for all Works on previously felled timber and grubbing areas in accordance with Section 01 35 43 - Environmental Procedures, when Work is to occur outside of the least risk window. Bird surveys must be completed by a Registered Professional Biologist.

.4 Removal and disposal of previously felled timber.

.5 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.3 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"**, and no additional payment will be made.

.4 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

1.4 DEFINITIONS

.1 Flush cutting consists of cutting trees, stumps or vegetative growth to within 100 mm of the ground, leaving the root structure undisturbed and disposing of felled trees, previously uprooted trees, stumps and clearing wood debris as specified.

.2 Clearing consists of cutting trees and brush vegetative growth to within 300 mm of the ground and disposing of felled trees, previously uprooted trees, stumps, and clearing wood debris as specified.

.3 Grubbing consists of excavation and disposal of stumps, roots and wood debris to a depth of 0.6m below the ground line.

.4 Chipping consists of chipping wood debris, except merchantable timber, into wood chips. Finished wood chip material shall be able to pass through a 100 mm by 100 mm screen.

.5 Merchantable timber is all timber with butt diameter in excess of 150 mm and top down to 100 mm.

1.5 QUALITY CONTROL

.1 In accordance with Section 01 45 00 – Quality Control.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.8 PROTECTION

.1 Prevent damage to trees, natural features, benchmarks, existing pavement, water courses and root systems of trees that are to remain.

.1 No grubbing to be completed with 1m of the tree drip line.

.2 Repair any damaged items to approval of Departmental Representative.

.3 Replace any trees designated to remain, if damaged, as directed by Departmental Representative.

.4 Contractor shall take all measures to ensure that trees do not fall into streams, rivers, wetlands or water bodies or outside the clearing limits as marked by colored flagging. Work within a 30 metre buffer of watercourses, water bodies or wetlands to be in accordance with Section 01 35 43 – Environmental Procedures.

.5 Trees inadvertently felled into streams, rivers, watercourses or outside the clearing limits shall be removed by means (e.g. winch) so as not to damage the substrate or any standing trees left outside the clearing limits. Machinery shall not go outside the clearing limits, or into streams, rivers, watercourses or water bodies to remove felled trees.

.6 Logs and other salvage materials are to be conveyed to and placed at the storage site without spread of debris or damage to other standing trees or landscape resources outside the marked clearing or storage limits. They shall not be skidded through wetlands, waterways or water bodies.

.7 During the grubbing component, stumps, roots, imbedded logs and other non-soil debris shall be pulled and shaken free of loose soil and rocks before transport.

.8 No slash clearing, pickup or grubbing shall occur outside of the designated area or within 1 metre of the drip line of existing forest.

.9 Existing areas of vegetation disturbed as a result of this Contract shall be rehabilitated using approved topsoil from the Park and a native grass seed mix as specified in Section 32 92 22 –Seeding and Hydro-Mulching.

Part 2 Product

2.1 NOT USED.

Part 3 Execution

3.1 PREPARATION

.1 Inspect site and verify with Departmental Representative, items designated to remain.

.2 The extent of grubbing shall be as indicated in the Contract Documents and the Contractor shall not commence work on this activity until approval to proceed has been granted by the Departmental Representative.

3.2 GRUBBING

.1 Grub out stumps and wood debris including roots and embedded logs up to a depth of 0.6m below the ground surface.

.2 Grubbing ripper teeth depth shall be kept as shallow as possible to minimize contamination of topsoil with subsoils. This may require individual ripping of stumps in some locations. In addition, while removing stumps, roots or embedded logs, the Contractor shall shake them on site to remove as much soil as possible.

3.3 REMOVAL AND DISPOSAL

.1 All removed wood and vegetative materials shall be loaded, hauled and disposed of outside of the National Park.

.1 PCA reserves the right to and may retain ownership of various natural materials handled throughout the course of construction.

.2 Burning of Woody Debris can only be carried out when a Restricted Activity Permit (RAP) has been requested, granted and authorized by Parks Canada as coordinated with the Departmental Representative and in accordance with Section 01 35 43 – Environmental Procedures. Burning of woody debris is not guaranteed.

.3 Contractor is responsible for ensuring weights and dimensions of all haul vehicles meet all applicable regulations.

3.4 FINISHED SURFACE

.1 In areas of grubbing, leave ground surface in condition suitable for stripping of topsoil to approval of Departmental Representative.

.2 In areas of flush cutting, leave stumps cut flush with ground elevation and root structure undisturbed.

.3 Finished surface requirements:

.1 In areas of flush cutting, leave stumps cut flush with ground elevation and root structure undisturbed unless otherwise directed by the Departmental Representative.

.2 Where possible, vegetative debris should not be left to accumulate on site and must either be burned or chipped.

.3 Chips cannot exceed two inches in depth to a maximum coverage of 5% ground cover.

.4 Where accessible, all stems suitable for firewood should be removed from site, hauled and stockpiled at a location designated by the Departmental Representative.

.5 At inaccessible sites or for trees with little firewood value, no more than 50 stems per linear kilometer may be left on site. A stem is defined as any tree with a diameter at breast height (DBH) greater than 15 centimeters.

.6 All retained stems must be limbed and lie flush to the ground.

.7 Accumulation of fine wood y fuels is of greatest concern from both a fire management and vegetation re-growth perspective. Fine fuel accumulation cannot exceed 10% ground cover and must be less than 10 centimeters in depth. Fine woody fuels have a diameter less than 3 centimeters.

.8 Medium fuels may accumulate to a maximum of 20% ground cover and shall not exceed 20 centimeters in depth. Medium fuels have a diameter ranging from 3 centimeters to 7 centimeters

.9 Mechanical distributed areas and burn piles must be seeded with an approved native grass seed mix within 6 months of project completion.

.10 Ground disturbance must be kept to a minimum. Off-highway mechanical equipment must have tire pressure of 7 psi or lower.

END OF SECTION

31 23 33.01 EXCAVATING, TRENCHING AND BACKFILLING

Part 1 General

1.1 DESCRIPTION

.1 Excavating, trenching and backfilling for underground services as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

.2 For general earthworks refer to Section 31 24 13 – Stripping and Excavation.

1.2 REFERENCES

.1 City of Calgary Waterworks and Sewer Construction Specifications (latest edition)

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM C117-[04] , Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-[05] , Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63[2002], Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-[00ae1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbr/ft^3) (600 kN-m / m^3).

.5 ASTM D1557-[02e1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbr/ft^3) (2,700 kN-m / m^3).

.6 ASTM D4318-[05] , Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.3 CSA Group (CSA)

.1 CAN/CSA-A3000-[03] , Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001-[03] , Cementitious Materials for Use in Concrete.

.2 CSA-A23.1 / A23.2-[04] , Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard Practices for Concrete.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Excavation for trenching will not be measured and paid for separately and will be considered incidental to the Work requiring trenching.

.2 Surplus material generated from trenching activities that is suitable for fill shall be used elsewhere on site. This material shall be measured in place after placement in cubic metres. Payment will be made under **"Excavation – Place Surplus from Trenching"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents. Double handling of material will not be paid for.

.3 Items considered incidental to the Work include, but are not limited to:

.1 Supply, loading, hauling and installation, including compaction and conditioning, of pipe zone bedding and backfill materials.

.2 Overhaul.

.3 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.4 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"**, and no additional payment will be made.

.5 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

1.4 DEFINITIONS

.1 Bedding Material: Materials placed at the bottom of the trench beneath and up to the spring line of the pipe.

.2 Pipe foundations: Sub grade material immediately below bedding.

.3 Initial Backfill: Non frozen material placed within the trench, above the spring line of the pipe to 300 mm above the crown of the pipe in layers not exceeding 150mm and compacted by manual forces (wacker tampers) to 98 % Standard Proctor Density.

.4 Class 2 Backfill: Class 2 backfilling shall consist of replacing the non-frozen excavated material in even layers not exceeding 300 mm in depth and compacting each layer by mechanical means to 95% Standard Proctor Density in landscaped areas and 98% Standard Proctor Density within the road carriage way.

.5 Bedding Class:

.1 Type 2 Installation

.1 Pipe is bedded on a minimum 100 mm thickness of compacted approved granular material placed on an undisturbed non frozen trench bottom. Approved granular material shall be hand placed and compacted to a density of 95% Standard Proctor Density in 150mm layers, or to the spring line of the pipe whichever is less, for the full width of the trench up to 300mm above the crown of the pipe. Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Shape transverse depressions as required to receive bell if bell and spigot pipe is used. Gradation of bedding material shall be as per this Section.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

.3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.

1.6 QUALITY CONTROL

.1 In accordance with Section 01 45 00 – Quality Control.

.2 Do not use soil material until written report of soil test results are approved by Departmental Representative.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 – Environmental Procedures.

1.8 PROTECTION

.1 Existing Buried Utilities

.1 Size, depth and location of existing utilities shown on Drawings are for guidance only; completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify applicable utility authorities, and establish location and state of use of buried services. Clearly mark such locations to prevent disturbance during work

.3 Maintain and protect from damage, water, sewer, gas, electric or other utilities encountered.

.4 Obtain written authorization of Owner of utility and Departmental Representative before moving or otherwise disturbing utility.

.2 Existing Surface Features

.1 Protect existing buildings, trees and other plans, fencing, service poles, wires or paving located within the working area while work in progress. Repair to Departmental Representative's satisfaction any damage which may occur.

.2 Where excavation necessitates root or branch cutting do so only under the direct control of the Departmental Representative.

.3 Protect existing trees and shrubs, unless specified for removal in accordance with these specifications.

.3 Shoring and Bracing

.1 Whenever shoring, sheeting, timbering and bracing of excavations is required, engage services of a professional Departmental Representative to design and assume responsibility for adequacy of shoring and bracing. Professional Departmental Representative is to be registered in Alberta.

.2 When requested by the Departmental Representative, submit for review drawings and calculations signed and stamped by the professional Departmental Representative responsible for their preparation.

.3 Close sheeting, when required, to be designed and constructed to prevent adjacent soil or water from entering excavation.

.4 Access

.1 Maintain unobstructed access to the spine road.

.5 Flooding

.1 Protect open excavation against flooding and damage from surface water runoff and groundwater seepage

.6 Safety Requirements

.1 Observe and adhere to all applicable section s of the Alberta Regulations 271 / 76 or any revisions thereto made under the Occupational Health and Safety Act covering the worker safety in trenches and excavations, shoring and bracing as

required. Open cut trenches shall be shaped as required by the Act and the Accident Prevention Regulations of the Occupational Health and Safety Division of the Department of Labor and Municipal Ordinances and as may be necessary to protect life, property, the environment and the Work.

.2 Adhere to all crossing permit (railway, pipeline, telecommunications, etc.) requirements.

.3 Provide barricades, flares, etc. to adequately denote area of excavation adjacent to roadways and public thoroughfares.

Part 2 Products

2.1 PIPE BEDDING AND BACKFILL MATERIALS

.1 Class II - Coarse-Grained Soils; clean or borderline clean to w / fines as per City of Calgary Sewer and Waterworks Specifications.

.2 The material shall meet the following gradation:

FOR PIPE 375MM AND SMALLER	
SIEVE SIZE	**PERCENT PASSING (BY MASS)**
20 mm	100 %
4.75 mm (#4)	Varies
0.075 mm (#200)	0 – 12 %

.3 Native hand placed material may be used as initial backfill gradation

.4 Material to be used as specified by Departmental Representative or as shown on drawing.

.5 Native backfill to be approved material selected from trench excavation or other source, unfrozen and free from deleterious material and with moisture content within 2% of optimum.

2.2 ROADWAY TRENCH BACKFILL MATERIAL

.1 To minimize fill settlement under self-weight, excavated soil with a moisture content exceeding 2% of optimum shall be conditioned and dried prior to use as backfill.

.2 Wet fill material must be dried or blended with drier material to produce a uniform homogenous material prior to use as a trench backfill. If this is not practical, the wet material should be wasted or used in landscape areas and where bearing capacity is not required.

.3 Suitable replacement soils would include imported clay with a moisture content within 2 % of its optimum moisture content for compaction or imported granular materials suitable for compaction

2.3 SAMPLES

.1 At least 2 weeks prior to commencing work, inform of proposed source of granular materials.

.2 The Contractor shall provide a sieve analysis of the pipe bedding for approval.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove trees, shrubs, vegetation, fences and other obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Strip topsoil from within limits of excavation and stockpile as directed, for respreading after backfilling. Avoid intermixing of subsoil fill materials with organic material and from other forms of contamination

.3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.4 Protect buried services that are required to remain undisturbed.

3.2 DEWATERING

.1 Keep excavation dry while work is in progress.

.2 Any dewatering plans are to be reviewed and approved by ESO.

.3 Dispose of water in a manner not detrimental to public health, environment, public and private property or any portion of work completed or under construction.

3.3 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions indicated on drawing. Ground profiles are approximate only.

.1 Trench width:

.1 The minimum trench width below the crown of the pipe shall be not less than the nominal diameter of the pipe plus 400 mm. The maximum width of the trench below the crown of the pipe including shoring shall be not more than the nominal diameter of the pipe plus 600 mm or not more than a total width of 1000 mm, whichever is the larger. Where the maximum trench width is exceeded, the Contractor shall, at his own expense, provide special bedding or take other precautions as directed. Where more than one pipe is laid in the same trench, the minimum and maximum widths shall be as directed.

.2 The Contractor shall confine his activities to the immediate area of the trench. All activities outside trench boundaries shall be performed so as not to damage other existing features. The Contractor shall generally have the option of using either vertical shored trenches or Vee trenches. Every effort shall be made to restrict the trench widths to minimize the area disturbed.

.3 Maximum disturbance limits have been defined in the drawings and the Contractor is not permitted to disturb any ground outside of these. Should the limit be inadequate for any reason the Contractor shall seek approval from the Departmental Representative for alternate solutions.

.4 All excavated material shall be piled at least 1.0 m clear of the trench top to prevent material from falling back into the excavation. The material shall be piled in such a manner that it will not endanger the work or obstruct other work or

rights-of way. Sufficient clear space must be left on one side of the trench to accommodate the surveyor's stakes.

.5 The trench shall be excavated so that the pipe can be laid to the correct grade.

.2 Cut pavement neatly along limits of proposed excavation.

.3 Where edge of existing pavement is damaged as a result of trench excavation in shoulder, a minimum 300 mm width to be cut neatly and continuously and reinstated.

.4 Notify Departmental Representative when soil at proposed elevation of trench bottom appears unsuitable for foundation of installation. Remove unsuitable material and replace with approved 40 mm screened rock bedding.

.5 Notify Departmental Representative if new construction conflicts with a discovered obstruction. Allow Departmental Representative sufficient time to consider alternative alignment to avoid conflict with obstruction. Modify alignment as directed by Departmental Representative.

.6 Unless otherwise authorized by Departmental Representative, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m of open trench at end of days operation.

.7 Stockpile suitable excavated materials required for trench backfill in approved location.

.8 Dispose of surplus and unsuitable material at a waste site designed by Departmental Representative of a site located by contractor and approved by Departmental Representative.

.9 Do not obstruct flow of surface drainage or natural watercourses.

.10 Obtain Departmental Representatives approval for method of excavation.

.11 Excavate rock to a level 150 mm below the barrel of pipe

.12 Restrict vehicle operations directly adjacent to open trenches.

3.4 TRENCH BOTTOM PREPARATION

.1 Where required due to removal of unsuitable material or unauthorized over excavation, bring bottom of excavation to design grade with approved material.

.2 Unstable Subgrade.

.1 Where the subgrade of the trench is unstable or will not properly support the pipe, or where it contains materials harmful to the pipe such as ashes, cinders, refuse, vegetable or organic material, the Contractor shall excavate such material to the width, depth and length as directed and dispose of the material. The subgrade shall then be made by backfilling with an approved stabilizing gravel compacted in 75 mm layers. The finished subgrade surface shall be shaped by hand tools to provide a uniform and continuous support for the pipe.

.2 The stabilization gravel may be completely wrapped in filter fabric as specified. The fabric shall be overlapped a minimum of 500 mm at all joints to provide a full, continuous wrap and shall be smooth and free of tension, stress, folds, wrinkles or creases.

.3 Where the subgrade cannot be made to properly support the pipe by replacing unsound material with stabilizing gravel, the Contractor shall construct a foundation for the pipe in accordance with a stamped drawing prepared at the time by a Professional Departmental Representative.

.3 Payment for this work shall be made in accordance with the provisions for extra work unless specified otherwise. Place unshrinkable fill in areas as indicated.

3.5 BEDDING AND BACKFILL

.1 Granular Bedding

.1 Place granular bedding materials to Class B unless otherwise indicated on drawings.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.3 Shape transverse depressions in bedding as required to accommodate bells when applicable.

.4 Compact full width of bed to a density of 98% Standard Proctor.

.5 Place layers simultaneously on both sides of installed work to equalize loading.

.6 Place material by hand under, around, and over pipe until 300 mm of cover is provided. Dumping material directly on pipe will not be permitted.

3.6 BACKFILLING

.1 Bedding and initial backfilling shall be as specified for the particular pipe installed.

.2 General Backfilling

.1 Class 1 backfill as defined in Section 1.2 - Definitions shall be used underneath all existing asphalt road or concrete areas. Class 2 backfill as defined in Section 1.2. Definitions shall be used in all other areas including future roads, boulevards and open areas.

.2 No boulders, rock, ice, snow, organic material or debris shall be permitted in the trench. These unsuitable materials shall be hauled away.

.3 All surplus excavated material shall also be hauled away or disposed of as directed. In the event of deficiency of backfill material, suitable material shall be supplied by the Contractor at his expense.

.4 All trenches shall be backfilled as the work proceeds and no more than 30 m shall be left open at the end of a day's work.

3.7 BACKFILL COMPACTION

.1 The Contractor shall be responsible for adequate compaction of the trenches and for the correction of settlement during the maintenance period of the Contract. Mechanical compaction equipment shall not be used until there is sufficient cover to prevent damage to the pipe.

.2 The type of compaction equipment shall be chosen with regard to minimizing the vibration effect on nearby buildings and utilities. The Contractor shall inspect the condition of buildings prior to construction. The Contractor is responsible for any damage caused to buildings due to construction

3.8 TESTING BACKFILL COMPACTION

.1 Compaction results shall be based on a minimum of one density test per 100 meters of trench for each 1.0 meter of compacted vertical backfill. Additional tests may be called for by the Departmental Representative as deemed necessary.

.2 If a density test indicates insufficient compaction at any depth, then two more densities, that are proportionally representative of trench length, shall be taken at that depth. If the average of these tests is below the required density, the trench shall be re-excavated and re-compacted to meet the specified density.

.3 This testing in no way relieves the Contractor of maintenance responsibilities with respect to settlements as specified. The Contractor shall repair any settlement and damaged surface improvements due to the settlement which occurs during the maintenance period.

.4 The cost of all initial testing will be borne by the Contractor. Non-conformity with the specified density or moisture content shall constitute sufficient grounds for rejection of the work.

3.9 PLOUGHING, TRENCHING AND BACKFILL FOR SHALLOW UTILITIES

.1 This clause shall apply to the installation of power, gas, telephone and cable.

.2 Ploughing

.1 Any restaking made necessary by Contractor's failure to preserve the stakes shall be charged to the Contractor's account. Contractor shall be responsible for staking the location of all plastic couplings which are assembled and installed in the field to eliminate the cost and time involved in attempting to locate couplings for inspection during testing.

.2 Contractor shall plough-in the pipeline as staked by the Departmental Representative. The pipe shall be ploughed-in at a minimum cover over the pipe of 90 centimetres. The depth of the trench shall be measured from the original ground level. It will be necessary to provide additional depth at certain locations such as access roads, ravines, water courses, farm terraces, crossing of other underground structures, and where extra depth is required by any public authority having jurisdiction over same.

.3 Road and lane crossings, roads, lanes or other areas that will be subject to traffic, are to be backfilled as outlined under Class 1 or Class 2 backfill in clause 1.2 of this section.

.4 Where applicable, pipeline identification and danger markers shall be installed on either side of crossings located on property lines.

.5 Where required, the Contractor is to bore through the crossing, the carrier pipe is to be pulled back directly using a reamer of not less than 50mm larger diameter than the outside diameter of the carrier pipe.

.6 Trenches in landscaped areas shall be backfilled and compacted as follows:

.1 Place initial 350 mm ±lift of native backfill material and compact to 95% Standard Proctor Maximum Dry Density.

.2 Place balance of backfill material in 300mm lifts and compact to 95% Standard Proctor Maximum Dry Density.

.3 Following compaction of final lift, fill depression with native material leaving a slight hump over trench to accommodate future settlement. Level surrounding area.

3.10 RESTORATION

.1 Clean and reinstate areas affected by work in accordance with the Contract requirements.

END OF SECTION

31 24 13 STRIPPING AND EXCAVATION

Part 1 General

1.1 DESCRIPTION

.1 This item consists of the excavation and use / disposal of all materials in conformity with the lines, grades and dimension indicated in the Contract Documents and as directed by the Departmental Representative and includes:

.1 Stripping of organic material.

.2 Roadway, culvert and borrow excavation.

.3 Construction of roadway ditches, embankments, permanent access and connecting roads, approaches, entrances, campsites, pathways, day use areas, berms, approved haul roads and other earthworks necessary for construction.

.4 Removal and disposal of waste / surplus materials from excavation, embankment and borrow areas.

.5 Transportation of excavated materials.

.6 Finishing of top surfaces and slopes.

.7 Maintenance of the work set forth under this section in a finished condition until any portion thereof has been accepted as completed by the Departmental Representative.

.2 The site is currently recovering from a wildfire and the understory vegetation of herbs and shrubs is regenerating very successfully. There are numerous areas of disturbance throughout the area related to the campground which must be repaired or reclaimed. Soils on site are shallow and poorly developed on site, but it is also full or large course rocky fragments. The soils will be poor quality and salvage of even a few centimetres of topsoil will be critical as it will be full of the natural propagules of the rare plants.

.3 For underground utility excavation and trenching, refer to Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 AT - Standard Specifications for Highway Construction (latest edition).

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbr/ft3) (600 kN-m / m3).

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Stripping and placement in stockpiles:

.1 Measure for payment for Stripping will be the volume in cubic metres measured in its original position from cross sections taken by the Contractor in areas of excavation. Work is to be done in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment will be made under **"Topsoil Stripping to Stockpile"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials,

equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Excavation, not including trenching for underground utilities:

.1 Measure for payment for Common Excavation will be the volume in cubic metres measured in its original position from cross sections taken by Contractor in areas of excavation. Work is to be done in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment will be made under **"Excavation - Common"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.1 Surplus common excavation shall be stockpiled on site as directed by the Departmental Representative for use in the future campground construction works.

.3 Measure for payment for Excavation deemed by the Departmental Representative as Waste will be the volume in cubic metres measured in its original position from cross sections taken by the Contractor in areas of excavation. Work is to be done in accordance with the Contract Documents and accepted by the Departmental Representative.

.1 Payment will be made under **"Excavation – Common"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.1 Waste excavation shall be stockpiled on site at a location determined by the Contractor and approved by the Departmental Representative.

.4 Written Approval to Proceed must be completed by the Departmental Representative prior to sub-excavation for the removal of waste material(s). Sub-excavation for the removal of waste material(s) to be paid under **"Excavation - Common".**

.5 The Contractor shall take care not to contaminate suitable surplus materials with Waste materials.

.6 Subgrade Preparation:

.1 Measure for payment for Subgrade Preparation will be the square metres of subgrade acceptably compacted and finished in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment will be made under "**Subgrade Preparation**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.7 The Contractor shall take initial cross sections upon completion of grubbing and again upon completion of stripping and immediately prior to excavation of material to be incorporated into work.

.8 Items considered incidental to the Work include, but are not limited to:

.1 General:

.1 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.1 Survey and layout.

.2 Construction of embankments, common fills, and all other site grading utilizing material sourced under "Excavation – Common" in accordance with the lines, levels, and all other requirements of the Contract is incidental to said item and there shall be no measurement for payment beyond that noted above under Clause 1.3.2 in this Section.

.3 Excavating, loading, hauling, placing and compacting material within the limits of the Works or disposing of surplus.

.4 Separating of organic material from non-organic material and stockpiling, as directed by the Departmental Representative.

.5 Loading hauling, placing and compaction of boulders less than 2.0 cubic metres into large embankments.

.6 Scarifying or benching existing slopes or existing road surfaces.

.7 Overhaul.

.8 Embankment construction.

.9 Watering, drying or compacting soils to achieve specified densities inclusive of all compaction efforts.

.10 Proof rolling.

.11 Compaction of material (150 mm) below subgrade horizon in areas of cut.

.12 Placing material in stockpiles, grading, or maintaining the stockpile site.

.13 Finishing.

.9 Stripping:

.1 Loading, hauling and stockpiling stripping material, at location(s) as directed by the Departmental Representative.

.10 Waste:

.1 Excavation, loading, hauling, and disposal of outside of the Parks at a location determined by the Contractor.

.2 Obtaining, maintaining and reclamation of a disposal site outside of the Parks and all incidentals associated with the removal and disposal of waste.

.11 Rock Excavation:

.1 Drilling, blasting, rock hammering, excavation, loading, hauling, placement and or disposal of waste / surplus material as directed by the Departmental Representative.

.2 Over-excavation and over-break beyond the Limits of Excavation, and secondary breaking of oversize material resulting from blasting will not be measured for payment.

.3 Structural support, remedial work, half barrels, or blast hole traces shall not be visible on the final rock face.

.12 In addition to incidental items, no measure for payment will be made for:

.1 Stripping below the design ditch grade.

.2 Excavating and/or construction embankments unnecessarily beyond design lines established by Departmental Representative, with exception of unavoidable slide material. Do not measure slide material, when such slides are attributable to negligence.

.3 Contractor contaminated suitable surplus materials with waste materials. Contaminated waste materials shall be removed from the Park at the Contractor's expense.

.4 Ditch or backslope overcut below the design grade line and/or filling back to design grade.

.5 If overcut, no payment will be made for filling an area back to grade.

.6 Removing waste material from embankment attributable to negligence.

.13 Mobilization and demobilization required for this Work shall be incidental to "**Mobilization / Demobilization",** and no additional payment will be made.

.14 Traffic Control required for this Work shall be incidental to "**Traffic Accommodation**" and no separate payment will be made to the Contractor.

1.4 DEFINITIONS

.1 Rock Excavation: excavation of:

.1 All forms of "solid rock in place" occurring in masses, ledges, seams or layers of sufficient hardness to require breaking by continuous drilling and blasting before excavation and removal.

.2 Detached masses of rock or boulders individually containing a volume of 2.0 cubic metres or more.

.2 Common Excavation: excavation and placement of material obtained from within the disturbance limits that is not Rock Excavation or Stripping.

.3 Stripping: excavation of organic material covering original ground.

.4 Borrow:

.1 Suitable material obtained from locations outside the limits of the roadway cut and placed as embankment material.

.2 Suitable material obtained from culvert foundation excavations used for the onsite production of granular material.

.5 Embankment: material derived from usable excavation and placed above original ground or stripped surface.

.6 Waste Material: material unsuitable for embankment, embankment foundation, and material surplus to requirements.

.7 Topsoil: material passing a 100 mm sieve and capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.5 QUALITY CONTROL

.1 Regulatory Requirements:

.1 Adhere to regulations of authority having jurisdiction when blasting is required.

.2 Adhere to Provincial and National Environmental requirements when potentially toxic materials are involved.

.2 In accordance with Section 01 45 00 – Quality Control.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 MATERIALS

.1 Embankment materials require acceptance by Departmental Representative.

.1 The Contractor shall provide material test certificates to the Departmental Representative for consideration.

.2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.

Part 3 Execution

3.1 UTILITY COORDINATION

.1 In accordance with Section 01 14 00 - Work Restrictions.

.2 Coordinate relocations or protection of utilities (manholes, ducts, conduits or other associated infrastructure) with utility service providers and perform works required to complete relocation or protection. Work to be in accordance with utility service provider instruction or as directed by the Departmental Representative.

.3 Existing buried utilities are to be located at all new culvert locations and every 100 m along segments of the Work where the utilities may be damaged by the Work, by using low impact excavation such as hydrovac or similar methods which will not damage buried utilities.

.4 Payment for locating utilities to be incidental to the Works and no additional payment will be made.

3.2 COMPACTION EQUIPMENT

.1 Compaction equipment must equivalent of one 12 tonne vibratory packer capable of obtaining required densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.

3.3 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution and in accordance with Section 01 35 43 – Environmental Procedures.

3.4 STRIPPING OF TOPSOIL

.1 Commence topsoil stripping of areas on acceptance by the Departmental Representative after clearing and grubbing debris have been removed from these areas.

.2 Stripping depth for the removal of organic material is estimated to be on average 50 mm but will fluctuate from one location to the other. Contamination of non-organic material will not be permitted during stripping.

.3 Strip topsoil to depths as verified by the Departmental Representative. Do not mix topsoil with subsoil. Stripping depth will vary.

.4 Reusable stripping material is to be stockpiled onsite, or other location(s) as directed by the Departmental Representative.

.5 Stripped soil (including fine forest litter) materials shall be placed and stored at locations and in amounts and form as instructed by the Departmental Representative, for later reclamation use on graded slopes. Stripping piles may require erosion control, sedimentation protection or stabilization, depending on the location and anticipated duration of storage. At the Departmental Representatives direction, the Contractor shall prepare a plan for management of each stripping pile.

3.5 EXCAVATING

.1 General:

.1 Notify the Departmental Representative when waste materials are encountered and remove to depth and extent as approved by the Departmental Representative. This material shall be hauled to and stockpile at the designated pit locations.

.2 Subcut below subgrade elevation in cut sections only as approved by the Departmental Representative and replace with acceptable embankment material and compact. Compact top 300 mm below final subgrade elevation to minimum 100% Standard Proctor density, ASTM D698 (AASHTO T99). No subcut in ditches or backslope unless Departmental Representative approved.

.3 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points in accordance with the Contract Documents.

.4 The dimensions of the excavations and embankments shall be, in accordance with the typical sections accompanying these specifications, but the dimensions of any or all excavations and embankments may be increased or decreased at any time by the Departmental Representative as conditions and circumstances may determine.

.2 Drainage:

.1 Maintain profiles, crowns and cross slopes to provide positive surface drainage at all times.

.2 Provide ditches as work progresses for positive drainage.

.3 Rock excavation:

.1 Notify the Departmental Representative if material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. The Contractor shall provide a minimum of 24 hours notice for the Departmental Representative to review the excavation.

.2 The Contractor shall submit statement of qualifications and experience of all personnel assigned to drilling and blasting duties. The driller and the blaster shall hold a current Surface Mine Blaster certificate as issued by Alberta Labour.

.3 The Contractor shall retain a blasting consultant, acceptable to the Departmental Representative, to provide a blast design and quality control. The blast consultant shall not be an employee of the Contractor, explosive manufacturer or explosive distributor. Prior to the pre-construction meeting, the Contractor shall provide the name and qualifications of the blasting consultant who shall hold a current Surface Mine Blaster certificate as issued by Alberta Labour.

.4 Submit a Rock Blast Design in accordance with Section 01 33 00 – Submittal Procedures and AT Standard Specification for Highway Construction (latest edition).

.5 Shatter rock to 300 mm below subgrade elevation.

.6 Contractor shall be responsible for safety of all blasting. Particular attention should be paid to control of rock falls from excavation slopes so there is no hazard to Park users and wildlife during construction. Contractor shall advise Departmental Representative 24 hours prior to blasting operations. Contractor shall control blasting so there is no flyrock damaging existing trees and vegetation.

.7 All rock on cut face that is loose, hanging or that creates a potentially dangerous situation shall be removed or stabilized during or upon completion of excavation of each lift. Drilling of next lift will not be allowed until this work has been completed. Other methods such as machine scaling, hydraulic splitters or light blasting may be used in lieu of, or to supplement hand scaling.

.8 Controlled Blasting:

.1 The purpose of controlled blasting is to minimize damage to rock back slope and to help ensure long-term stability.

.2 Controlled blasting will involve controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes to produce a free surface or shear plane in rock along specific excavation backs slope. Controlled blasting techniques will be used for this project.

.3 The slopes of the cut shall be scaled of all loose material and ditches shall be formed and cleaned.

.4 Subgrade shall be constructed to a true and uniform surface as to line and grade preparatory to application of sub-base material.

3.6 EMBANKMENTS

.1 This item consists of the construction of the subgrade in embankments and cuts to the lines, grades, cross-sections and dimensions as per the Contract Documents.

.2 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces. Method used to be subject to prior approval of the Departmental Representative.

.3 Do not place material that is frozen nor place material on frozen surfaces except in areas authorized.

.4 Maintain crowned surface during construction to ensure ready run-off of surface water.

.5 Drain low areas before placing materials.

.1 Place and compact to full width in layers not exceeding 200 mm loose thickness. The Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.

.6 Rock Embankments:

.1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 0.7 m.

.2 Distribute rock material to fill voids with smaller fragments to form compact mass.

.3 Fill surface voids at design elevation with rock spalls or selected material to form earth-tight surface.

.4 The Contractor may place rock embankments during freezing conditions provided compaction equipment of sufficient size to break large rock particles is used and all snow and ice is removed from fill surface.

.7 Deductions from excavation will be made for overbuild of embankments.

.8 Excess Excavation placed in stockpile in the designated pits:

.1 Material in the quantities specified shall be placed in the designated pits or as otherwise directed by the Departmental Representative.

.2 The Contractor shall place, grade and track pack the material in stockpile as necessary to allow for construction access and the movement of equipment.

.3 The Contractor shall maintain access to the stockpile area and allow for access to the stockpiled material by others.

.4 Materials placed in the designated pits, once accepted by the Departmental Representative, are the property of PCA.

3.7 SUBGRADE COMPACTION

.1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.

.2 Embankment material shall be placed in successive uniform layers over the entire area as follows:

.1 Material containing less that 25 percent by volume of stones larger than 100 mm shall be constructed in successive horizontal layers not exceeding 200 mm in loose thickness except that the top 500 mm shall be constructed in layers not exceeding 100 mm in loose thickness

.2 Material containing 25 percent or more by volume of stones larger than 100 mm shall be placed in layers not exceeding the maximum size of the stones. Stones larger than 100 mm shall not be placed within 150 mm of the subgrade elevation.

.3 In embankments composed principally of material obtained from rock cuts, the larger stones shall be carefully distributed and the interstices filled with smaller stones and other material to form a compact mass. Such embankments shall be constructed in layers not exceeding 0.7 metre. The placing of individual rocks and boulders exceeding 0.7 metres in least dimension will be permitted provided they are carefully distributed and the interstices filled with finer material to form a dense and compact mass. Each layer, before starting the next, shall be levelled and smoothed with suitable equipment. Hauling and spreading equipment shall be operated over the full width of each layer.

.3 Each layer shall be brought to its required degree of compaction throughout its entire width before successive layers are placed.

.4 Compact each layer to minimum 95% Standard Proctor density, ASTM D698 (AASHTO T99). Top 300 mm of subgrade to be compacted to 100% Standard Proctor density, ASTM D698 (AASHTO T99).

.5 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

.6 For rock placed as fill, compact with large steel wheeled or tracked equipment of sufficient size to break larger particles. Compact until rock fill is stable under compaction equipment and all voids are filled.

3.8 PROOF ROLLING

.1 Finished subgrade must not rut or deflect when proof rolled with a truck having a 9 tonne single axle dual tire or 17 tonne tandem axle group with dual tires with a tire pressure of 600 kPa. The prepared subgrade shall receive one complete coverage by the tires of a truck as specified.

.2 Proof roll subgrade. If use of non-standard proof rolling equipment is approved, Departmental Representative to accept level of proof rolling.

.3 Where proof rolling reveals areas of defective subgrade:

.1 Remove subgrade material to depth and extent as directed by Departmental Representative.

.2 Backfill excavated subgrade with suitable Common material and compact in accordance with Section 31 24 13 – Stripping and Excavation.

.3 Replace subgrade material and compact in accordance with the Contract Documents.

.4 All associated Works, including replacing defective material with new materials in accordance with the appropriate Sections is to be done at the Contractor's cost.

3.9 FINISHING

.1 Shape entire subgrade to within ±15 mm of design elevations but not to be uniformly high or low.

.2 Round top of back slope as shown on the Drawings.

.3 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.

.4 Trim between constructed slopes and edge of clearing to provide drainage.

3.10 PROTECTION

.1 Maintain finished surfaces in condition conforming to this section until acceptance by the Departmental Representative.

END OF SECTION

31 32 19 GEOTEXTILES

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of Geotextiles including but not limited to non-woven geotextile, geo-grid and silt fences as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

.2 ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

.3 ASTM D4716, 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, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.5 ASTM A123 / A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2-M89(R2013), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.

.3 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.

.4 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.

.5 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.

.6 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.7 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-G40.20 / G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.

.4 AT - Standard Specifications for Highway Construction (latest edition)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Geotextile for culverts:

.1 This work shall be incidental to the Contract and will not be measured for payment.

.2 Geotextile for road, pathway and campsite subgrade:

.1 Measure for payment of geotextile for subgrade shall be in square meters of 2D surface covered by geotextile supplied and installed in accordance with the Contract Documents and accepted by the Departmental Representative.

.1 Overlapping at seams will not be measured or paid for separately.

.2 Payment for the supply and placement of geotextile for subgrade will be made under **"Non-Woven Geotextile for Subgrade**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Items considered incidental to the Work include, but are not limited to:

.1 All items as described in the Contract Documents.

.2 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.4 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"**, and no additional payment will be made.

.5 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 Submit samples in accordance with 01 33 00 – Submittal Procedures for each type of geotextile or geogrid used.

.2 Submit copies of mill test data and certificates 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.

.2 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

.2 Unused geotextiles to be removed from the Parks at the Contractor's expense.

Part 2 Products

2.1 MATERIAL

.1 In accordance with the Contract Documents and Geotechnical Report.

.2 Nonwoven geotextile for culvert and landscaping shall meet or exceed the specifications of Nilex 4552 Non-Woven Geotextile. If the Contractor wishes to propose an alternate

non-woven geotextile, the approval is subject to the discretion of the Department Representative.

.3 Turnaround and Trailhead Parking Lots

.1 Granular Base Course – AT Type B Geotextile at base of layer

.4 Unpaved Trails

.1 Subgrade - AT Type B Geotextile at base of layer on top of subgrade

Part 3 Execution

3.1 INSTALLATION

.1 Geogrid and geotextile for road base, campsite, granular and paved pathway requirements:

.1 Unroll geogrid / textile in the direction of travel so that the long axis of the roll is parallel with channelized traffic patterns.

.2 Overlap each successive strip of geogrid / textile 600 mm over previously laid strip.

.3 Overlapping of geogrid / textile should be such that it avoids peeling by the advancing fill.

.4 Mechanically connect adjacent strips of geogrid if required.

.5 Cut and overlap geogrid / textile as recommended by the manufacturer and as approved by the Departmental Representative to accommodate curves.

.6 Protect installed geogrid / textile material from displacement, damage or deterioration before, during and after placement of material layers.

.7 Replace damaged or deteriorated geogrid / textile to the approval of Departmental Representative.

.8 Install as per manufacturer's specifications.

3.2 PROTECTION

.1 Vehicular traffic not permitted directly on geotextile or geogrid.

END OF SECTION

32 01 90.33 TREE AND SHRUB PRESERVATION

Part 1 General

1.1 DESCRIPTION

.1 Protection of existing trees and shrubs designated to remain as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA G30.5-[M1983(R1998)], Welded Steel Wire Fabric for Concrete Reinforcement.

.2 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Fertilizers Act (R.S. 1985, c. F-10).

.3 Fertilizers Regulations (C.R.C., c. 666).

.4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.3 Health Canada - Pest Management Regulatory Agency (PMRA).

.1 National Standard for Pesticide Education, Training and Certification in Canada (1995).

1.3 DEFINITION

.1 Mycorrhiza : association between fungus and roots of plants. This symbiosis enhances plant establishment in newly landscaped and imported soils.

1.4 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment for preservation will be Lump Sum in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Tree and Shrub Preservation**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Items considered incidental to the Work include, but are not limited to:

.1 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.4 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

.5 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"** and no separate payment will be made to the Contractor.

1.5 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit monthly written reports on maintenance during warranty period, to Departmental Representative identifying:

.1 Maintenance work carried out.

.2 Development and condition of plant material.

.3 Preventative or corrective measures required which are outside Contractor's responsibility.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

.2 Remove materials defined as hazardous or toxic and dispose of outside of the Parks.

1.8 SCHEDULING

.1 Obtain approval from Departmental Representative of schedule indicating beginning of Work.

1.9 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.

.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

.2 Apply pesticides in accordance with National Standard for Pesticide Education, Training and Certification in Canada, Federal, Provincial and Municipal regulations as and when required to control insects, fungus and disease. Obtain product approval from Departmental Representative prior to application.

.3 Apply fertilizer in early spring at manufacturer's suggested rate.

.4 Remove dead, broken or hazardous branches from plant material. Dispose of debris through composting or mulching.

Part 2 Products

2.1 MATERIALS

.1 Fill:

.1 Type (A): clean, natural river sand and gravel material, free from silt, clay, loam, friable or soluble materials and organic matter.

.2 Type (B): excavated or pervious soil, free from roots, rocks larger than 75 mm, building debris, and toxic ingredients (salt, oil, etc.). Excavated material shall be approved by Departmental Representative before use as fill.

.2 Coarse washed stones: 35-75 mm diameter clean round hard stone.

.3 Draintile: 100 mm diameter corrugated coded plastic perforated tubing complete with snap couplings. Fill vents with 20 mm clear stone.

.4 Peat moss:

.1 Derived from partially decomposed species of Sphagnum Mosses.
.2 Elastic and homogeneous.
.3 Free of wood and deleterious material which could prohibit growth.
.4 Shredded minimum particle size: 5 mm.

.5 Fertilizer:
.1 To Canada Fertilizer Act and Fertilizers Regulations.
.2 Fertilizer as per soil tests.

.6 Anti-desiccant: commercial, wax-like emulsion.

.7 Filter Cloth:
.1 Type 1: 100 % non-woven needle punched polyester, 2.75 mm thick, 240 g/m2 mass.
.2 Type 2: biodegradable burlap.

.8 Wood posts: 38 x 89 x 2400 mm length, untreated wood.

.9 Welded wire fabric (WWF): 102 x 102 mm, MW 13.3 / MW 13.3, to CSA G30.5.

Part 3 Execution

3.1 IDENTIFICATION AND PROTECTION

.1 Identify plants and limits of root systems to be preserved as approved by Departmental Representative.

.2 Protect plant and root systems from damage, compaction and contamination resulting from construction as approved by Departmental Representative.

.3 Ensure no pruning is done inside drip line. If pruning inside drip line is required consult an arborist or Canadian Certified Horticultural Technician (CCHT) as approved by Departmental Representative.

3.2 ROOT CURTAIN SYSTEM

.1 Identify limits for required construction excavation as approved by Departmental Representative.

.2 Prior to construction excavation, hand dig trench minimum 500 mm wide x 1500 mm deep, along perimeter of excavation limits.

.3 Prune exposed roots cleanly at side of trench nearest plants to be preserved. Pruned ends to point obliquely downwards.

.4 Install posts and welded wire fabric against construction edge of trench.

.5 Securely attach Type 2 filter fabric on plant side of wire mesh.

.6 Prepare homogeneous mixture of fertilizer, parent material and organic matter.
.1 Add organic matter to mixture to achieve 7-9 % organic matter content by weight.
.2 Incorporate with mixture grade 2:12:8 ratio fertilizer (dry) at rate of 1.5 kg/m^3.

.7 Backfill with homogeneous mixture between curtain wall and plants to be preserved in layers not exceeding 150 mm in depth. Compact each layer to 85% Standard Proctor Density.

.8 Protect root curtain from damage during construction operations.

.9 Water plants and root curtain sufficiently during construction to maintain optimum soil moisture condition until backfill operations are complete.

.10 Remove root curtain before backfilling operations. Ensure root curtain is cut down to 300 mm below finished grade and remove cut material.

3.3 AIR LAYERING SYSTEM

.1 Using manual methods, carefully remove turf, plants, leaves and organic matter in area of root system, and slightly loosen topsoil surface. Avoid damage to root system.

.2 Lay horizontal system of perforated drainpipe on surface of existing grade.

.1 Slope drain tile minimum 3 % for drainage away from trunk of tree.

.2 Connect system with general site drainage system or drain to low point on site.

.3 Install plastic "vent" pipes vertically over joints in horizontal pipe system or where indicated. Top of vent pipe to be 20 mm above finished grade of fill. Keep top of vent pipe covered during construction.

.4 Cover joints with filter fabric and place coarse washed stone around joints and vertical pipes to secure their position.

.5 Construct drywell around trunk of tree.

.1 Ensure open ends of horizontal pipe system and vertical vent pipes are left exposed for air circulation to root system.

.2 Protect openings from blockage during construction.

.3 Install protective caps on exposed horizontal openings.

.6 Place 200 mm depth of coarse washed stone on surface of original ground and horizontal pipe system to limits.

.7 Place filter fabric over surface of granular layer.

.8 Place Type A fill over filter fabric to required depth without disturbing or damaging drainpipe system. Avoid damage to filter fabric.

.9 Complete topsoil and seeding over area of sub-surface system within one week of placing fill.

.10 Remove temporary protective covering from vent pipe openings. Install protective caps flush with finished grade.

3.4 TRENCHING AND TUNNELING FOR UNDERGROUND SERVICES

.1 Centre line location and limits of trench / tunnel excavation to be approved by Departmental Representative prior to excavation. Tunnel excavation to extend 2000 mm from edge of trunk on either side.

.2 Excavate manually within zone of root system. Do not sever roots greater than 40 mm diameter except at greater than 500 mm below existing grade. Protect roots and cut roots cleanly with sharp disinfected tools.

.3 Excavate tunnel under centre of tree trunk using methods and equipment approved by Departmental Representative.

.4 Minimum acceptable depth to top of tunnel: 1000 mm.

.5 Backfill for tunnel and trench to 85 % Standard Proctor Density. Avoid damage to trunk and roots of tree.

.6 Complete tunnelling and backfilling at tree within 2 weeks of beginning Work.

3.5 LOWERING GRADE AROUND EXISTING TREE

.1 Begin Work in accordance with schedule approved by Departmental Representative.

.2 Cut slope not less than 500 mm from tree trunk to new grade level.

.3 Excavate to depths as indicated. Protect from damage root zone which is to remain.

.4 When severing roots at excavation level, cut roots with sharp tools.

.5 Cultivate excavated surface manually to 15 mm depth.

.6 Prepare homogeneous soil mixture consisting by volume of:

.1 60 % excavated soil cleaned of roots, plant matter, stones, debris.

.2 25 % coarse, clean sterile sand.

.3 15 % organic matter.

.4 Fertilizer at rate of 1.5 kg/m^3.

.7 Place soil mixture over area of excavation to finished grade level. Compact to 85 % Standard Proctor Density.

.8 Water entire root zone to optimum soil moisture level.

.9 Install surface cover of seeding in accordance with Section 32 92 22 – Seeding and Hydro-Mulching.

3.6 PRUNING

.1 Prune crown to compensate for root loss while maintaining general form and character of plant. Dispose of debris as directed by the Departmental Representative.

3.7 ANTI-DESICCANT

.1 Apply anti-desiccant to foliage where applicable and as directed by Departmental Representative.

3.8 VERIFICATION

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Local / regional materials.

.5 Low-emitting materials.

END OF SECTION

32 11 20 GRAVEL FILL

Part 1 General

1.1 DESCRIPTION

.1 Installation of AT Designation 6 Class 80 Gravel Fill for use in construction as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

.1 AT Designation 6 Class 80 Gravel Fill can be produced by screening onsite native excavation or taken from the SMS Pit stockpile of Pit Run.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D422-63(2007)e2, Standard Test Method for Particle-Size Analysis of Soils.

.5 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbr/ft3) (600kN-m / m3).

.6 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbr/ft3) (2,700kN-m / m3).

.7 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.8 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 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 AT - Standard Specifications for Highway Construction (latest edition)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment of AT Designation 6 Class 80 Gravel Fill will be in tonnes of material supplied and incorporated into the work in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment shall be made under "**AT Designation 6 Class 80 Gravel Fill (Granular Pathway)"** the applicable item below the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Contractor to provide complete and accurate scale tickets, including a summary sheet in tonnes, for Gravel Fill to the Departmental Representative within 24 hours of placing the material onsite.

.4 If required, a conversion factor from tonnes to cubic meters will be based on the accepted material proctor results.

.5 Items considered incidental to the Work include, but are not limited to:

.1 Screening, loading, hauling, placing, compacting, water for compaction, drying of material and finishing.

.2 Supply, installation, maintenance and calibration of weight scales, scale house and scale person.

.3 Overhaul.

.4 Any temporary stockpiling of aggregates onsite.

.5 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.6 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"**, and no additional payment will be made.

.7 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 – Quality Control.

.2 Contractor to provide material samples to the Departmental Representative prior to works commencing for Quality Assurance purposes.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

.2 Unused Gravel Fill to remain property of the Contractor and no additional payment will be made.

Part 2 Products

2.1 MATERIALS

.1 AT Designation 6 Class 80 Gravel Fill is to be produced from native excavation screening in accordance with Section 31 05 16 – Aggregate Production.

Part 3 Execution

3.1 PLACING

.1 Gravel Fill

.1 Load, haul and place Gravel Fill after subgrade has achieved the requirements of the Contract Documents.

.2 Construct Gravel Fill to depth and grade in areas indicated in the Contract Documents.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice. For each lift, material shall be placed on crown line using a Tonne / metre Spread Sheet. Contractor shall have a checker to indicate spread distance when material is being placed.

.5 Begin spreading Gravel Fill material on crown line or high side of one-way slope.

.6 Place granular Gravel Fill materials using methods that do not lead to segregation or degradation.

.7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds that will place material in uniform layers of required thickness.

.8 Place material to full width in uniform layers not exceeding 200 mm loose thickness.

.9 Shape each layer to smooth contour and compact to the specified density before succeeding layer is placed.

.10 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to density of not less than 100% Standard Proctor density in accordance with ASTM D698.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted subgrade.

.4 Apply water as necessary during compaction to obtain specified density.

.5 Dry as necessary to obtain specified density.

.6 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.

.7 Heavy earth compacting equipment or other heavy construction equipment shall not be used within 3.0m of the abutments or wing walls.

.8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 PROOF ROLLING

.1 Gravel fill must not rut or deflect when proof rolled with a truck having a 9 tonne single axle dual tire or 17 tonne tandem axle group with dual tires with a tire pressure of 600 kPa. Each compacted course of base course aggregate shall receive one complete coverage by the tires of a truck as specified.

.2 Proof roll granular Gravel fill. If use of non-standard proof rolling equipment is approved, Departmental Representative to accept level of proof rolling.

.3 Where proof rolling reveals areas of defective Gravel fill:

.1 Remove Gravel fill material to depth and extent as directed by Departmental Representative.

.2 Backfill excavated subgrade with suitable Common material and compact in accordance with Section 31 24 13 – Stripping and Excavation.

.3 Replace Gravel fill material and compact in accordance with the Contract Documents.

.4 All associated Works, including replacing defective material with new materials in accordance with the appropriate Sections is to be done at the Contractor's cost.

3.4 SITE TOLERANCES

.1 Finished Gravel fill surface to be within ± 15mm of elevation as indicated but not uniformly high or low.

3.5 PROTECTION

.1 Maintain finished subgrade in condition conforming to this section until succeeding base is constructed.

END OF SECTION

32 11 24 GRANULAR BASE COURSE

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of AT Granular Base Course Designation 2 Class 25 for use in road construction as shown in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbr/ft3) (600kN-m / m3).

.5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbr/ft3) (2,700kN-m / m3).

.6 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 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 AT - Standard Specifications for Highway Construction (latest edition)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment of AT Granular Base Course Designation 2 Class 25 will be in tonnes of material supplied and incorporated into the work in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment shall be made under the applicable item below and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.1 “AT Designation 2 Class 25mm Granular Base Course (Roads)”

.3 Contract to provide complete and accurate scale tickets, including a summary sheet in tonnes, for Gravel Fill to the Departmental Representative within 24 hours of placing the material onsite.

.4 If required, a conversion factor from tonnes to cubic meters will be based on the accepted material proctor results.

.5 Items considered incidental to the Work include, but are not limited to:

.1 Supply, loading, hauling, placing, compacting, water for compaction, drying of material and finishing.

.2 Supply, installation, maintenance and calibration of weight scales, scale house and scale person.

.3 Overhaul.

.4 Any temporary stockpiling of aggregates onsite.

.5 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.6 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization**", and no additional payment will be made.

.7 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 – Quality Control.

.2 Contractor to provide material samples to the Departmental Representative prior to works commencing for Quality Assurance purposes.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

.2 Unused granular material to remain property of the Contractor and no additional payment will be made.

Part 2 Products

2.1 MATERIALS

.1 AT Designation 2 Class 25 Base Course Aggregate to be supplied by the Contractor from outside the Park.

Part 3 Execution

3.1 PLACING

.1 Load, haul and place base aggregate after sub-base aggregate surface is inspected and accepted by Departmental Representative.

.2 Placing

.1 Construct base aggregate to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice. For each lift, material shall be placed on crown line using a Tonne / metre spreadsheet.

Contractor shall have a checker to indicate spread distance when material is being placed.

.4 Begin spreading base aggregate on crown line or on high side of one-way slope.

.5 Place material using methods that do not lead to segregation or degradation of aggregate.

.6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds that will place material in uniform layers of required thickness.

.7 Place road, pathway and campsite material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved.

.1 Granular Base Course for pathways may be placed in one lift.

.8 Shape each layer to smooth contour and compact to the specified density before succeeding layer is placed.

.9 Remove and replace that portion of layer in which material becomes segregated during spreading.

3.2 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to density not less than 100% Standard Proctor density in accordance with ASTM D698.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.4 Apply water as necessary during compacting to obtain specified density.

.5 Dry as necessary to obtain specified compaction.

.6 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

.7 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 PROOF ROLLING

.1 Granular Base Course must not rut or deflect when proof rolled with a truck having a 9 tonne single axle dual tire or 17 tonne tandem axle group with dual tires with a tire pressure of 600 kPa. Each compacted course of base course aggregate shall receive one complete coverage by the tires of a truck as specified.

.2 Proof roll Granular Base Course. If use of non-standard proof rolling equipment is approved, Departmental Representative to accept level of proof rolling.

.3 Where proof rolling reveals areas of defective Granular Base Course, Gravel fill or subgrade:

.1 Remove Gravel fill and subgrade material to depth and extent as directed by Departmental Representative.

.2 Backfill excavated subgrade with suitable Common material and compact in accordance with Section 31 24 13 – Stripping and Excavation.

.3 Replace Gravel fill and/or Granular Base Course material and compact in accordance with the Contract Documents.

.4 All associated Works, including replacing defective material with new materials in accordance with the appropriate Sections is to be done at the Contractor's cost.

3.4 SITE TOLERANCES

.1 Finished base surface to be within +/- 10 mm of established grade and cross section but not uniformly high or low.

.2 Finished sub-base surface to be within +/- 15 mm of elevation as indicated but not uniformly high or low.

3.5 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied.

END OF SECTION

32 15 40 HIGH FINES GRANULAR SURFACING AGGREGATE

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of 25mm high fines granular surfacing aggregate (HFSA) for pathways as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 ASTM International

.1 ASTM C136-[06], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM C117-[04], Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM D4318-[05], Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.4 ASTM D698-[07e1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbr/ft3 (600 kN-m / m3).

.2 Canadian General Standards Board (CGSB) .1

.1 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.

1.3 MEASUREMENT FOR PAYMENT

.1 Measure for payment of High Fines Granular Surfacing Aggregate (HFSA) will be in tonnes of material supplied and incorporated into the work in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment shall be made under the applicable item below and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.1 “25mm High Fines Granular Surfacing Aggregate (Granular Pathway)”

.3 Contract to provide complete and accurate scale tickets, including a summary sheet in tonnes, for HFSA to the Departmental Representative within 24 hours of placing the material onsite.

.4 If required, a conversion factor from tonnes to cubic meters will be based on the accepted material proctor results.

.5 Items considered incidental to the Work include, but are not limited to:

.1 Supply, loading, hauling, placing, compacting, water for compaction, drying of material and finishing.

.2 Supply, installation, maintenance and calibration of weight scales, scale house and scale person.

.3 Overhaul.

.4 Any temporary stockpiling of aggregates onsite.

.6 Environmental mitigations required Traffic Control required during work identified under this Section shall be included under **" Traffic Accommodation"** and no separate payment will be made to the Contractor.

.7 Mobilization and demobilization required for this Work shall be included under **"Mobilization / Demobilization"** and no separate payment will be made to the Contractor.

1.4 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Two (2) weeks after contract award, inform Parks Representative of proposed source of granular materials.

.3 The Contractor shall provide a sieve analysis of the material for approval.

.4 Granular materials shall be approved by Departmental Representative before being used.

1.5 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

.2 Once removed from its existing location, all existing concrete curb and gutter shall become the property of the Contractor who shall dispose of it outside the National Parks in an approved facility.

Part 2 Products

2.1 MATERIALS

.1 Non-woven geotextile: in accordance with Section 31 32 19 - Geotextiles.

.2 25mm HFSA:

.1 Screenings: hard, durable, crushed stone particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations: within limits specified when tested to ASTM C136.

Sieve Designation	% Passing
25	100
19	85 - 100
12.5	-
9.5	60 – 85
6.3	-
4.75	40 - 70
2.36	-
1.18	20 - 40

Sieve Designation	% Passing
0.60	-
0.30	10 - 25
0.075	7 - 12

.3 Asphalt millings or Reclaimed Asphalt Pavement products will not be permitted in place of 25mm HFSA.

Part 3 Execution

3.1 GRAVEL TOPPING

.1 Place granular topping to compacted thickness of 50mm minimum.

.2 Place material in uniform layers not to exceed 50mm compacted thickness.

.3 The gravel must be laid upon a dry firm sub-grade / gravel base, true to grade and cross-section and free from all screening or other loose or foreign material. No gravel to be installed when the sub-grade / gravel base is wet or when other conditions prevent proper spreading, finishing or compaction of the gravel.

3.2 FIELD QUALITY CONTROL

.1 Inspection and testing of crushed stone paving:

.1 Trails:

.1 Acceptance of base course and topping course shall be based on proof roll of gravel areas to be conducted using a loaded gravel truck or large grader / loader. Truck to traverse all gravel areas at a walking pace, with any deflection noted. Deflection up to 25mm will be deemed acceptable upon visual inspection by Departmental Representative provided that gravel rebounds and does not rut. Any aggregate with unacceptable levels of deflection or where rutting occurs shall be excavated and the problem identified and corrected. The supply, load, haul, placing, proof rolling, and mixing of such stabilizing aggregates as necessary to correct deficiencies in aggregate stability shall be incidental to the Work.

.2

END OF SECTION

32 91 19 TOPSOIL PLACEMENT AND GRADING

Part 1 General

1.1 DESCRIPTION

.1 The site is currently recovering from a wildfire and the understory vegetation of herbs and shrubs is regenerating very successfully. There are numerous areas of disturbance throughout the area related to the campground which must be repaired or reclaimed. Soils on site are shallow and poorly developed on site, but it is also full or large course rocky fragments. The soils will be poor quality and salvage of even a few centimetres of topsoil will be critical as it will be full of the natural propagules of the rare plants.

.2 Topsoil to be native organic soils stripped from the Contract Work area and placed on finished slopes from stockpile(s) as directed by the Departmental Representative.

1.2 REFERENCES

.1 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 Canadian Council of Ministers of the Environment

.1 PN1340-[2005], Guidelines for Compost Quality.

.3 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

.4 AT Standard Specifications for Highway Construction (latest edition)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment for topsoil placement and finishing will be in cubic metres measured in its original position (from stockpiles) acceptably installed within the areas indicated in the Contract Documents or as approved by the Departmental Representative, regardless of depth.

.2 Payment for topsoil placement will be made under **"Topsoil Placement"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Items considered incidental to the Work include, but are not limited to:

.1 Preparing the finished grade.

.2 Loading and hauling from stockpiles.

.3 Placing and fine grading.

.4 Preparing the topsoil materials for planting.

.5 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.4 Stockpiles will be measured by Departmental Representative and volume of topsoil removed calculated by surface to surface prismoidal method.

.5 Traffic Control shall be incidental to **"Traffic Accommodation"** and no additional payment will be made.

.6 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"** and no additional payment will be made.

1.4 DEFINITIONS

.1 Compost:

.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 – Environmental Procedures.

.2 Divert unused soil amendments from landfill to official hazardous material collections site, outside of the Parks, as approved by Departmental Representative.

.3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 TOPSOIL

.1 Unless otherwise approved by the Departmental Representative, topsoil is to be sourced from onsite stripping and no topsoil from outside of the Park will be permitted.

.2 Topsoil for seeded areas and planting beds: Native soil to be stripped from designated onsite source. Soil will be stripped carefully and only the amount that must be stripped will be removed. Soil will be piled by type including the LFH, topsoil and parent material.

2.2 QUALITY CONTROL

.1 In accordance with Section 01 45 00 – Quality Control.

.2 Advise Departmental Representative of sources of topsoil and manufactured topsoil to be utilized with sufficient lead time for testing.

.3 Contractor is responsible for amendments to supply topsoil as specified.

.4 Soil testing by recognized testing facility for PH, P and K, and organic matter.

.5 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.

.1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 In accordance Section 01 35 43 – Environmental Procedures

.2 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 sediment and erosion control drawings, sediment and erosion control plan, specific to site, that complies with EPA 832 / R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

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

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

3.2 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.

.1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris that protrudes more than 75mm above surface.

.3 Dispose of removed material off site.

.4 Cultivate entire area that is to receive topsoil to minimum depth of 100 mm.

.1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 SCREENING OF STRIPPING MATERIAL

.1 None.

3.4 PLACING AND SPREADING OF TOPSOIL / PLANTING SOIL

.1 Place topsoil after Departmental Representative has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 100 mm.

.3 Spread topsoil as indicated to following minimum depths after settlement.

.1 100 mm for seeded areas.

.2 600 mm for shrub beds.

.4 Manually spread topsoil / planting soil around trees, shrubs and obstacles.

3.5 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.

.2 Prepare loose friable bed by means of cultivation and subsequent raking.

.3 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.

.4 Leave surfaces smooth, uniform and firm against deep footprinting.

3.6 ACCEPTANCE

.1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.7 SURPLUS MATERIAL

.1 Excess topsoil is to be placed at locations as directed by Departmental Representative.

END OF SECTION

32 92 22 SEEDING AND HYDRO-MULCHING

Part 1 General

1.1 DESCRIPTION

.1 Preparation and application of Hydro-mulch with Owner supplied seed as required to complete the work in accordance with the Contract Documents and as directed by the Departmental Representative.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment for Seeding and Hydro-Mulching will be by the hectare acceptably installed resulting in full grass growth, 75% germination and growth of specified seed mixture, within the dimensions indicated in the Contract Documents or as approved by the Departmental Representative.

.2 Payment for seeding and hydro-mulching shall be made under **"Seeding and Hydro-Mulching"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Items considered incidental to the Work include, but are not limited to:

.1 Retrieving seed from PCA and preparing hydro-mulch.

.2 Areas of blending into existing landscape will not be measured for payment.

.3 Maintenance.

.4 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.4 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"**, and no additional payment will be made.

.5 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

1.3 SUBMITTALS

.1 In accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data

.1 Provide product data for:

.1 Seed

.2 Mulch

.3 Tackifier / Soil Stabilizer

.2 Submit in writing to Departmental Representative prior to commencing work:

.1 Volume capacity of hydraulic seeder in litres.

.3 Amount of material to be used per tank based on volume.

.4 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 – Quality Control.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties to be provided to the Departmental Representative.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Use all means necessary to protect all materials before, during and after installation. Provide adequate protection to materials that may deteriorate if exposed to weather.

.2 Seed to be stored in dry weatherproof place and shall be protected from damage by heat, rodents and other causes. Deliver and store grass seed in original packages with label indicating:

.1 Analysis of seed mixture;

.2 Percentage of pure seed by weight;

.3 Year of production;

.4 Net mass, and

.5 Date tagged and location.

Part 2 Products

2.1 SEED

.1 Owner supplied.

.2 Seeding rate to be 23.10 kg / ha for hydraulic seeding.

.3 The seeding will be completed on a pure live seed basis and seed certificates will be presented at least 3 weeks prior to seeding to a representative of Parks Canada. Within the seed mix there is one species of grass that must be carefully sourced *(Festuca idahoensis*). With recent testing of seed lots only one commercial seed lot met the requirements for use in this location and it is from BFI in Washington State. Any Idaho fescue used must be sourced from this location as the other seed lots are not suitable for use (do not conform in grow outs to the native Idaho fescue.

2.2 WATER

.1 In accordance Section 01 35 43 – Environmental Procedures

2.3 SOIL STABILIZER / TACKIFIER

.1 Soil stabilizer / tackifier shall be a nontoxic, colourless copolymer emulsion with no less than 52.6% solids. Acceptable product is: Soil Master WR or approved alternate.

2.4 MULCH

.1 Wood fibre mulch shall be manufactured from virgin wood fibres and contain not less than 3% of an organic tackifier by volume. Cellulose type products are not acceptable. Acceptable product is: Eco Fibre Plus or approved alternate.

Part 3 Execution

3.1 GENERAL

.1 Contractor shall advise Departmental Representative prior to the start of seeding operations.

.2 Contractor shall mechanically remove any weeds prior to seeding. Weed removal method to be approved by Departmental Representative prior to commencement. This will be incidental to the work.

.3 Contractor shall ensure that equipment is steam cleaned, free of soil and seed from previous project to prevent site contamination.

.4 Seeding shall be done upon completion of stripped soil material / chip compost placement.

.5 Contractor shall not perform work under adverse field conditions such as frozen soil, excessively wet or dry soil, or soil covered with snow, ice or standing water.

.6 Contractor shall seed only during dry weather conditions with no rain forecasted for the next 24 hours and ensuring a seasonably dry seedbed to provide for proper curing of soil stabilizers / tackifier. Contractor shall check weather conditions to ensure soil stabilizer has sufficient time to cure prior to heavy rainfall.

.7 Seeding shall be done to ensure a catch satisfactory to the Departmental Representative's approval. In areas where seed fails to germinate for whatever reason, the Contractor shall re-cultivate and reseed until acceptable germination takes place.

.8 Contractor shall carry out seeding in locations as per the Contract Documents or, as directed by Departmental Representative.

3.2 SEEDING AND HYDRO-MULCHING

.1 The following application rates are the minimum required for hydraulic seeding:

.1	Seed:	23.10 kg/hectare
.2	Mulch:	3900 kg/hectare
.3	Tackifier:	As per Manufacturer’s Instructions
.4	Water:	30,000 L/hectare

.2 Contractor to perform drill seeding with brillion drill at the rate of 23.1 kg/hectare. For the smaller areas broadcasting application is acceptable.

.3 The Contractor shall measure quantities of materials by weight, or weight calibrated Contractor to calculate and submit applicable area of coverage per tank load of slurry in accordance with Section 01 33 00 – Submittal Procedures.

.4 Contractor shall physically stake and identify limits of tank coverage prior to seeding to the satisfaction of Departmental Representative.

.5 Each tank load of slurry shall be fully applied within the designated boundaries for each load as staked volume measurement, to the satisfaction of the Departmental Representative.

.6 The Contractor shall fill the tank half full with required water and add mulch while continuing to fill with water. Fertilizer is to be added. All material is to be added into the hydraulic seeder under agitation. The Contractor shall pulverize mulch with tackifier and charge slowly into seeder.

.7 The Contractor shall charge soil stabilizer / tackifier into seeder after all other material is well mixed in seeder. Contractor shall mix slowly to avoid foaming but thoroughly to complete slurry.

.8 The Contractor shall use hydraulic seeding equipment with a minimum slurry tank capacity of 4500 litres.

.9 The Contractor's equipment shall have an agitation system for slurry capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and mechanical method:

.1 Pumps shall be capable of maintaining a continuous non-fluctuating flow of solution.

.2 Equipment shall be capable of seeding up to 150m distance from hydraulic seeder using hand operated hoses and appropriate nozzles.

.10 The Contractor shall apply slurry when wind velocities will not affect the application and cause the mixture to be blown.

.11 The Contractor shall apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed. Ensure good contact of slurry with soil with minimal air pockets.

.12 The Contractor shall use the correct nozzle(s) for application and use hoses to access difficult to reach surfaces and to control application.

.13 The Contractor shall ensure that the application is uniform and the surface is evenly covered. Contractor shall blend into retained landscape for approximately 1 metre.

.14 The Contractor shall clean all structures, appurtenances and natural features not designated to be seeded of any overspray, to the satisfaction of the Departmental Representative.

.15 The Contractor shall ensure that at all times during the seeding, that no vehicles are parked within the path of public travel and the Contractor shall provide warning devices as directed by the Departmental Representative to ensure safe operations.

.16 Traffic Control to be in accordance with Section 01 35 31 – Special Procedures for Traffic Control.

3.3 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Establishment period is a minimum of four months of continuous growing season. Growing season shall not to be divided by winter.

.2 The Contractor shall repair and reseed dead or bare spots, as directed in the Contract Documents, to Departmental Representative's satisfaction, to allow establishment of seed prior to acceptance. In the case of erosion, the Contractor shall be compensated at the specified unit rates for reseeding.

.3 For areas of poor seed germination and growth, as determined by the Departmental Representative, the soil shall be scarified or re-cultivated as directed by the Departmental Representative and seeding and fertilizing undertaken as specified. This work is incidental to the Contract.

3.4 CONSTRUCTION COMPLETION ACCEPTANCE

.1 Seeded areas will be accepted by the Departmental Representative provided that all areas are uniformly established, and turf is not eroded or rutted and relatively free of weeds. Seeded areas to be growing for a minimum of four continuous months prior to construction completion acceptance inspection.

.2 Areas seeded in fall will be accepted in following spring, a minimum of four months after start of growing season, provided acceptance conditions are fulfilled.

.3 Minimum 75% growth by area of coverage of specified seed mixture must be present in order to be acceptable.

3.5 MAINTENANCE DURING WARRANTY PERIOD

.1 Maintenance shall occur for one full year from Substantial Performance. The estimated period of maintenance within one calendar year shall be from approximately April 1 to October 31. The Contractor will be required to employ all of the necessary measures to establish and maintain all seeding in an acceptable, vigorous and healthy growing condition.

.2 The Contractor shall repair and reseed dead or bare spots, as directed in the Contract Documents, to Departmental Representative's satisfaction, to allow establishment of seed prior to acceptance. In the case of erosion, the Contractor shall be compensated at the specified unit rates for reseeding.

.3 For areas of poor seed germination, or as determined by the Departmental Representative, the soil shall be scarified or re-cultivated as directed by the Departmental Representative and seeding and fertilizing undertaken as specified. This work is incidental to the Contract.

.4 For small areas of poor seed germination or as determined by the Departmental Representative, the soil shall be scarified to a depth of 25 mm and seeding and fertilizing shall be undertaken as specified. This work is incidental to the Contract.

.5 Weed control shall be undertaken as determined by the Departmental Representative. Hand pulling of weeds may be required. This work is incidental to the Contract.

END OF SECTION

32 93 10 TREES, SHRUBS AND GROUND COVER PLANTING

Part 1 General

1.1 DESCRIPTION

.1 Planting as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

.2 Install the Parks Canada supplied rare plants within the Crandell Mountain Campground

1.2 REFERENCES

.1 Agriculture and Agri-Food Canada (AAFC).

.1 Plant Hardiness Zones in Canada-[2000].

.2 Canadian Nursery Landscape Association (CNLA).

.1 Canadian Standards for Nursery Stock-[2001].

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Transportation of Dangerous Goods Act (TDGA), 1992, c.34.

1.3 DEFINITIONS

.1 Mycorrhiza: association between fungus and roots of plants. This symbiosis enhances plant establishment in newly landscaped and imported soils.

1.4 MEASUREMENT AND PAYMENT PROCEDURES

.1 Tree Planting – No. 25 Pot:

.1 Measure for payment for Tree Planting will be per tree acceptably installed resulting in full growth, 75% germination and growth of specified plant, within the dimensions indicated in the Contract Documents or as approved by the Departmental Representative.

.2 Payment shall be made under **"Tree Planting – No. 25 Pot"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Planting Areas c/w Planting Material and Bed Preparation:

.1 Measure for payment for Planting Areas c/w Planting Material and Bed Preparation will be square meters acceptably installed resulting in full growth, 75% germination and growth of specified plant, within the dimensions indicated in the Contract Documents or as approved by the Departmental Representative. Note: The installation of the "owner supplied, contractor installed" rare plant species shall be made under the 1.4.3.2 pay item.

.2 Payment shall be made under **"Planting Areas c/w Planting Material and Bed Preparation"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Rare Plant Species Planting (Owner Supplied, Contractor Installed):

.1 Measure for payment for Rare Plant Species Planting (owner supplied, contractor installed) will be for each plant installed. A list of the species and target quantities can be found under item 1.10 under section 01 11 00.

.2 Payment shall be made under **"Rare Plant Species Planting (Owner Supplied, Contractor Installed)"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.4 Items considered incidental to the Work include, but are not limited to:

.1 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.5 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"**, and no additional payment will be made.

.6 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

1.5 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data for:

.1 Fertilizer

.2 Anti-desiccant

.3 Guying assembly including clamps, collar, guying wire, anchors and wire tightener

.4 Mulch

.3 Submit samples for:

.1 Mulch

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

.2 Divert discarded plastic plant containers materials from landfill to plastic recycling facility approved by Departmental Representative.

.3 Dispose of unused fertilizer at official hazardous material collection site approved by Departmental Representative.

.4 Dispose of unused anti-desiccant at official hazardous material collections site approved by Departmental Representative.

.5 Divert unused wood and mulch materials from landfill to [recycling] [composting] facility approved by Departmental Representative.

1.8 STORAGE AND PROTECTION

.1 Protect plant material from frost, excessive heat, wind and sun during delivery.

.2 Immediately store and protect plant material which will not be installed within [1] hour[s] after arrival at site in storage location approved by Departmental Representative.

.3 Protect plant material from damage during transportation:

.1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.

.2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.

.3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.

.4 Protect stored plant material from frost, wind and sun and as follows:

.1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil and watering to full depth of root zone.

.2 For pots and containers, maintain moisture level in containers.

.3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

1.9 SCHEDULING

.1 Obtain approval from Departmental Representative of schedule 7 days in advance of shipment of plant material.

.2 Schedule to include:

.1 Quantity and type of plant material.

.2 Shipping dates.

.3 Arrival dates on site.

.4 Planting dates.

1.10 WARRANTY

.1 For plant material as itemized on plant list the warranty period one growing season following Substantial Performance.

.2 The Contractor hereby warrants that plant material as itemized on plant list will remain free of defects for 1 full growing season, providing adequate maintenance has been provided.

.3 End-of-warranty inspection will be conducted by Departmental Representative.

.4 Departmental Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

Part 2 Products

2.1 PLANT MATERIAL

.1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.

.1 Source of plant material: grown in Zone 4 in accordance with Plant Hardiness Zones in Canada.

.2 Plant material must be planted in zone indicated as appropriate for its species.

.3 Plant material in location appropriate for its species.

.2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.

.3 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.

.4 Trees larger than 200 mm in caliper: half root pruned during each of two successive growing seasons, the latter at least one growing season prior to arrival on site.

.5 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

.6 Collected stock: maximum 40 mm in caliper, with well developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.

2.2 WATER

.1 Free of impurities that would inhibit plant growth.

2.3 STAKES

.1 T-bar, steel, 40 x 40 x 5 x 2440 mm or wood, pointed one end, 38 x 38 x 2300 mm.

2.4 WIRE TIGHTENER

.1 Turnbuckle, galvanized steel, 9.5 mm diameter with 270mm open length.

2.5 GUYING WIRE

.1 Type 1: steel, 3 mm wire.

.2 Type 2: 1.5 mm diameter multi-wire steel cable.

.3 Type 3: 3 mm diameter multi-wire steel cable.

2.6 CLAMPS

.1 U-bolt: galvanized, 13 mm diameter, c/w curved retaining bar and hex nuts.

.2 Crimp type.

2.7 ANCHORS

.1 Wood:

.1 Type 1: 38 x 38 x 460 mm.

.2 Type 2: 38 x 67 x 600 mm.

.2 Drive-in type.

.1 Type 1: 13 mm diameter x 75 mm long, aluminum

.2 Type 2: 18 mm diameter x 120 mm long, aluminum

.3 Screw-in type:

.1 Type 1: 100 mm diameter steel disc

2.8 GUYING COLLAR

.1 Tube: plastic, 13 mm diameter, nylon reinforced.

2.9 TRUNK PROTECTION

.1 Wire mesh: galvanized, electrically welded 1.4 mm wire with 25 x 25 mm mesh and fastener.

.2 Plastic: perforated spiralled strip.

.3 Burlap: clean, minimum 2.5 kg/m^2 mass and 150 mm wide, and twine fastener.

.4 Tar impregnated crepe paper and twine fastener.

2.10 MULCH

.1 Bark chip: varying in size from 25 to 50 mm in diameter, from bark of coniferous trees.

.2 Wood chip: varying in size from 50 mm to 75 mm and 5 to 20 mm thick, free of bark, small branches and leaves.

.3 Shredded wood: varying in size from 25 to 125 mm in length, from coniferous trees.

.4 Synthetic or inorganic mulch.

2.11 FERTILIZER

.1 Synthetic commercial type as recommended by soil test report.

2.12 ANTI-DESICCANT

.1 Wax-like emulsion.

2.13 FLAGGING TAPE

.1 Fluorescent orange tape.

2.14 SOURCE QUALITY CONTROL

.1 Obtain approval from Departmental Representative of plant material prior to planting.

.2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

Part 3 Execution

3.1 PRE-PLANTING PREPARATION

.1 Ensure plant material acceptable to Departmental Representative.

.2 Remove damaged roots and branches from plant material.

.3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.2 EXCAVATION AND PREPARATION OF PLANTING BEDS

.1 For individual planting holes:

.1 Stake out location and obtain approval from Departmental Representative prior to excavating.

.1 Excavate to depth and width as indicated.

.2 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.

.3 Scarify sides of planting hole.

.4 Remove water which enters excavations prior to planting. Notify Departmental Representative if water source is ground water.

3.3 PLANTING

.1 For bare root stock, place 50 mm backfill soil in bottom of hole. Plant trees and shrubs with roots placed straight out in hole.

.2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.

.3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.

.4 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.

.5 For trees and shrubs:

.1 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.

.2 Form watering saucer as indicated.

.6 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.7 Water plant material thoroughly.

.8 After soil settlement has occurred, fill with soil to finish grade.

.9 Dispose of burlap, wire and container material off site.

3.4 TRUNK PROTECTION

.1 Install trunk protection on deciduous trees as indicated.

.2 Install trunk protection prior to installation of tree supports when used.

3.5 TREE SUPPORTS

.1 Install tree supports as indicated.

.2 Use single stake tree support for deciduous trees less than 3 m and evergreens less than 2 m.

.1 Place stake on prevailing wind side and 150 mm from trunk.

.2 Drive stake minimum 150 mm into undisturbed soil beneath roots. Ensure stake is secure, vertical and unsplit.

.3 Install 150 mm long guying collar 1500 mm above grade.

.4 Thread Type 1 guying wire through guying collar tube. Twist wire to form collar and secure firmly to stake. Cut off excess wire.

.3 Use 3 guy wires and anchors for deciduous trees greater than 3 m and evergreens greater than 2 m.

.1 Use Type 2 guying wire with clamps for trees less than 75 mm in diameter and Type 3 guying wire with clamps for trees greater than 75 mm in diameter.

.2 Use Type 1 anchors for trees less than 75 mm in diameter and Type 2 anchors for trees greater than 75 mm in diameter.

.3 Install guying collars above branch to prevent slipping at approximately 2/3 height for evergreens and 1/2 height for deciduous trees. Collar mounting height not to exceed 2.5 m above grade.

.4 Guying collars to be of sufficient length to encircle tree plus 50 mm space for trunk clearance. Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi-wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120 degrees.

.5 Install anchors at equal intervals about tree and away from trunk so that guy wire will form 30 degree angle with ground. Install anchor at angle to achieve maximum resistance for guy wire.

.6 Attach guy wire to anchors. Tension wire and secure by multi-wraps or installing clamps.

.7 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree.

.8 Saw tops off wooden anchors which extend in excess of 100 mm above grade or as directed by Departmental Representative.

.9 Install flagging tape to guys as indicated.

.4 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.6 MULCHING

.1 Ensure soil settlement has been corrected prior to mulching.

.2 Spread mulch as indicated.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following maintenance operations from time of planting to acceptance by Departmental Representative.

.1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.

.1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.

.2 Remove weeds monthly.

.3 Replace or respread damaged, missing or disturbed mulch.

.4 For non-mulched areas, cultivate as required to keep top layer of soil friable.

.5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.

.6 Remove dead or broken branches from plant material.

.7 Keep trunk protection and guy wires in proper repair and adjustment.

.8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.8 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations:

.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

.2 Reform damaged watering saucers.

.3 Remove weeds monthly.

.4 Replace or respread damaged, missing or disturbed mulch.

.5 For non-mulched areas, cultivate [monthly] to keep top layer of soil friable.

.6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.

.7 Apply fertilizer in early spring as indicated by soil test.

.8 Remove dead, broken or hazardous branches from plant material.

.9 Keep trunk protection and tree supports in proper repair and adjustment.

.10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.

.11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

.12 Submit monthly written reports to Departmental Representative identifying:

.1 Maintenance work carried out.

.2 Development and condition of plant material.

.3 Preventative or corrective measures required which are outside Contractor's responsibility.

3.9 VERIFICATION

.1 Verification requirements in accordance with Section 01 35 43 – Environmental Procedures[include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Local / regional materials.

.5 Low-emitting materials.

END OF SECTION

33 05 15 MANHOLES AND DRYWELL STRUCTURES

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of Manholes and Drywells as required to complete the work in accordance with the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM C478M, Specification for Precast Reinforced Concrete Manhole Sections.

.2 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.3 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbr/ft^3 (600 kN-m / m^3)).

.2 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 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000, Cementitious Materials Compendium.

.2 CSA-A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete.

.3 CSA-A165, CSA Standards on Concrete Masonry Units.

.4 CAN/CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.

.5 CAN/CSA-G164-M92R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

.4 2010 Engineering Design and Construction Guidelines, Town of Canmore.

.5 City of Calgary Standard Specification for Sewer Construction.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Supply and installation of Manholes:

.1 Measure for payment of manholes shall be in vertical meters (vm) supplied and installed, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment will be made under **"Type 5A manhole (miscellaneous)"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Supply and installation of Water Drain Manhole:

.1 Measure for payment for water drain manholes shall be each unit installed, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Water Drain Manhole Assembly**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Supply and installation of Drywells:

.1 Supply and installation of drywells will be incidental to "Future **Water Spigot Assembly**" in accordance with Section 33 14 16, the Contract Documents and accepted by the Departmental Representative.

.4 Items considered incidental to the Work include, but are not limited to:

.1 Supply, assembling, loading, hauling, unloading, stockpiling and protecting.

.2 The supply of gratings and ancillary materials and hardware.

.3 Supply and installation of drywell chambers, rock fill, tees and all appurtenances.

.4 Temporary stockpiling of materials, including retrieval from pits or staging areas.

.5 Any pipe to manhole connections, appurtenances, tooling, benching and grouting.

.6 Excavation, bedding and backfill.

.7 The survey and layout of drainage structures.

.8 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.5 The supply and installation of pipe anchors and anchor plates will not be measured directly for payment but shall be considered incidental**.**

.6 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"**, and no additional payment will be made.

.7 Traffic Control during the survey, layout, Construction of the Catch Basin structures shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.6 STAGED CONSTRUCTION

.1 Provisions for staged construction shall be shown in the shop drawings, including any temporary support required, until catch basin structure is complete.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 – Environmental Procedures.

Part 2 Products

2.1 MATERIALS

.1 City of Calgary Class 1A open graded Aggregate for pipe bedding, to be supplied by the Contractor from outside the Park.

.2 City of Calgary Class 1B dense graded Aggregate for manhole and drywells, to be supplied by the Contractor from outside the Park.

.3 Concrete mixes and materials: in accordance with City of Calgary Standard Specifications for Sewer Construction (latest edition) and Section 03 30 00 - Cast-in-Place Concrete.

.4 Type 5A manhole as per City of Calgary Specifications

.5 Type A 910mm I.D catch basin manhole barrel as per City of Calgary Specifications for the water spigot.

2.2 WATER DRAIN MANHOLE ASSEMBLY

.1 Drain manhole assembly as per Contract Documents

.2 Chamber to be installed as per City of Calgary Specifications with 1 meter diameter of drainage rock rapped in filter fabric surrounding the chamber as shown on the Drawing details.

.1 Filter fabric will overlap inside of chamber as shown on drawings and be anchored at the base of the chamber by overlapping the manhole joints

.2 Bottom half of chamber to be perforated, starting 300mm below the pipe invert in the chamber

.3 50 mm diameter City of Calgary approved (cross-linked polyethylene) “PEX” and 150mm PVC service into the drywells to be installed with a minimum 2% slope from 200mm or 150mm diameter PVC watermain to chamber.

Part 3 Execution

3.1 EXCAVATION AND BACKFILL

.1 Obtain approval of Departmental Representative before installing manholes or catch basins.

3.2 CONCRETE WORK

.1 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 on the drawings, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses. Maximum of 1 unit behind point of pipe laying will be allowed.

.3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.

.4 Precast units:

.1 Set precast concrete unit on 150 mm minimum of 25mm WGB bedding material compacted to 98% Standard Proctor density to ASTM D698 with the top of units at correct elevation.

.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.

.5 Grout around pipes that lead to and from the precast units and trim the pipes flush with the inside surface of the precast unit.

.6 Place concrete for bottom and bending, as per the Contract Documents.

.7 Compact granular backfill to 98% Standard Proctor density to ASTM D698 no sooner than seven (7) days after concrete placement.

.8 Place manhole frame and cover on top section to conform to finished grade. If adjustment is required, use concrete ring(s). Manhole lids to be between 10 – 50 mm below finished grade.

.9 Final position and elevation of manhole lids and catch basin grates to be reviewed by Contractor's Quality Control and Departmental Representative prior to acceptance.

.10 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

END OF SECTION

33 14 16 SITE WATER UTILITY DISTRIBUTION PIPING

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of watermain and water servicing pipe as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

.1 Commissioning testing equipment may include but is not limited too the supply of generators for power, connections, pumps and potable water supply for system testing will be required and incidental to the unit costs in this section.

1.2 REFERENCES

.1 American National Standards Institute / American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA B300-[10] , Standard for Hypochlorites.

.2 ANSI/AWWA B301-[10] , Standard for Liquid Chlorine.

.3 ANSI/AWWA B303-[10] , Standard for Sodium Chlorite.

.4 ANSI/AWWA C208-[07] , Standard for Dimensions for Fabricated Steel Water Pipe Fittings.

.5 ANSI/AWWA C500-[09] , Standard for Metal-Seated Gate Valves for Water Supply Service.

.6 ANSI/AWWA C504-[10] , Standard for Rubber-Seated Butterfly Valves.

.7 ANSI/AWWA C600-[10] , Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.

.8 ANSI/AWWA C506-[10], Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

.9 ANSI/AWWA C651-[05] , Standard for Disinfecting Water Mains.

.10 ANSI/AWWA C800-[05] , Standard for Underground Service Line Valves and Fittings.

.11 ANSI/AWWA C900-[07] , Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.

.12 ANSI/AWWA C900-[07] , Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.

.13 ANSI/AWWA C901-17 , Polyethylene (PE) Pressure Pipe and Tubing, 3 / 4 in. (19 mm) Through 3 in. (76 mm), for Water Service.

.2 ASTM International (ASTM)

.1 ASTM A53 / A53M-[10] , Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

.2 ASTM A123 / A123M-[09] , Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A307-[10] , Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.4 ASTM A312 / A312M-[19] , Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.5 ASTM B88M-[05(2011)] , Standard Specification for Seamless Copper Water Tube [Metric] .

.6 ASTM C117-[04] , Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.7 ASTM C136-[06] , Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.8 ASTM C478M-[11] , Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric] .

.9 ASTM D698-[07e1] , Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbr/ft^3(600 kN-m / m^3)).

.10 ASTM F714-[10] , Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.11 ASTM C618-[08a] , Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

.3 American Water Works Association (AWWA) / Manual of Practice

.1 AWWA M11-[2004] , Steel Pipe - A Guide for Design and Installation.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-[M88] , Sieves, Testing, Woven Wire, Metric.

.2 CGSB 41-GP-25M-[77] , Pipe, Polyethylene, for the Transport of Liquids.

.5 CSA Group (CSA)

.1 CAN/CSA-B137 Series-[09] , Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.2 CAN/CSA-B137.1-[09] , Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.3 CAN/CSA-B137.3-[09] , Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.6 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - [current edition].

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Supply and installation of Watermain Pipe:

.1 Measure for payment of watermain pipe in open trench will be the lineal meter measured along the surface above the pipe as per drawings, measured in place, service leads to all buildings and spigots / standpipes leads, through all valves, bends and fittings in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment for water main pipe shall be made under the applicable item below and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.1 "Water Mains (200mm PVC DR18)"

.2 "Water Mains (150mm PVC DR18)"

.3 "Water Service (50mm Cross-linked polyethylene PEX)"

.4 "Raw Water and Treated Water Line (50mm HDPE)"

.2 Supply and installation of Valves:

.1 Measure for payment for valves c/w casing, rods, top and bottom boxes, shall be each unit installed regardless of depth. in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment for valves shall be made under the applicable item below and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.1 "200mm Water Gate Valve"

.2 "150mm Water Gate Valve"

.3 "50mm Stop and Drain Water Valve"

.3 Supply and installation of Water Blow Off and Air Release assembly:

.1 Measure for payment for the blow off and air release assembly shall be in units installed, in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under "**Water Blow Off and Air Release Assembly**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.4 Supply and installation of the Water Meter Chamber:

.1 Measure for payment for Water Metre Chamber shall be Lump Sum, in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under **"Water Meter Chamber for Canyon Youth Camp"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.5 Supply and installation of Water Spigot Assembly

.1 Measure for payment for Future Water Spigot Assembly shall be each unit supplied and installed, in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under **"Future Water Spigot Assembly"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.6 Supply and installation of Sprinkler Standpipe Assembly:

.1 Measure for payment for Future Sprinkler Standpipe Assembly shall be each unit supplied and installed, in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under **"Future Sprinkler Standpipe Assembly"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.7 Supply and installation of Fire Hydrant:

.1 Measure for payment of the Supply and installation of hydrant, including extensions to be measured in units installed. **Unit Price – "Fire Hydrant"** Depth of bury shall be measured from top of pipe at the elbow to ground flange 50-250mm above final grade. Tendered price shall include bracing, washed rock drain pit, backfilling, thrust blocking, painting and all other work and material required to install hydrants to City of Calgary standards.

.2

.8 Items considered incidental to the Work include, but are not limited to:

.1 General:

.1 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.2 All survey, excavating, dewatering, shoring, trenching, backfill and bedding.

.3 Confirmation of proposed watermain alignments and grades at building (washroom and kiosk) water service connections. Contractor shall inform the Departmental Representative of any conflicts or changes, if different from the Contract Documents.

.2 Watermain:

.1 Pipe laying, jointing, tracer wire, fittings, restraints, reducers, bends, thrust blocking, service saddles, Tee's, cathodic protection, testing, flushing, disinfection, and all other appurtenances.

.2 Contractor shall coordinate with PCA, during the construction phase and during commissioning of active lines under this Contract.

.3 Valves:

.1 Jointing with appropriate connections, thrust blocking, tracer wire and cathodic protection.

.2 All 50mm valves (excluding corporation stops) shall be self draining valves.

.4 Water Blow Off and Air Release assembly:

.1 Installation of the standpipe assembly shall include a 25mm stainless steel water pipe encased in a 50mm steel riser sleeve and secured to a 100mm by 100mm square hollow steel post, centred within a 400mm Sonotube form and filled with type HS concrete. The water pipe shall be secured the water riser. An "Air Release" sign shall be attached on the steel post above the hose bib.

.5 Water Meter Chamber:

.1 Concrete manhole including, frame and grate, water service pipe connections, all mechanical piping, flow meter installation , valves, check valve, appurtenances, pipe supports, paint and waterproofing as shown on the design drawings.

.2 Contractor to provided and installed flow meter to have the following parameters and will need to be submitted (shop drawing) for approval:

.1 Supply and install flow meter for measuring chlorine treated potable water. To be NEPTUNE T-10 2 inch Pro Coder and flange connection set (or approved equal meter).

.2 A removable data storage recorder via USB or similar data transfer device.

.3 Battery operated or battery free meter operation.

.6 Future Water Spigot and Sprinkler Standpipe

.9 All future water spigot and sprinkler standpipe locations shall be terminated, protected and marked in accordance with the drawings. Marker posts shall be painted blue. Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

.10 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization".**

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials, valves, manholes, drywells, meter or vault chambers, air releases and spigots and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Pipe certification to be on pipe.

.3 Shop Drawings:

.1 Where indicated, submit drawings stamped and signed by Professional Engineer registered or licensed in Alberta, Canada.

.4 Samples:

.1 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 2 weeks prior to commencing work.

.2 Submit for testing 2 weeks minimum prior to beginning work, samples of materials proposed for use as follows:

.3 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 2 weeks minimum prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

.5 Closeout Submittals:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit 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.

.1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers.

.3 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.7 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.8 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval by Departmental Representative.

.3 Notify Departmental Representative a minimum of 48 hours in advance of any interruption in service.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

.1 Pipe

.1 Watermain 100mm in diameter and larger shall be Polyvinyl Chloride (PVC) Pipe DR18. Water pipe 50mm or smaller shall be Cross-linked Polyethylene (PEX) Pipe, as per City of Calgary standards unless otherwise shown. The water supply forcemain (water well to reservoir and related pipes) and associated drain lines shall be 50mm in diameter High Density Polyethylene (HDPE) Pipe.

.2 PVC Pipe

.1 Polyvinyl chloride pressure pipe to CAN3-B.137.3 (AWWA C900 for 100 mm to 300 mm diameter pipe and AWWA C905 for 350 mm to 1,200 mm diameter pipe), pressure class 150, cast iron outside diameter, designated DR 18 and colored blue

.2 Water distribution pipe to the spigots, air release and drain manholes to be municipal Cross-linked Polyethylene (PEX) Pipe.

.3 Stainless Steel Pipe

.1 Stainless steel pressure pipe ASTM A312 TP 304 / 316 stainless steel 40S to AWWA C220-17 pressure class 150, cast iron outside diameter. All buried pipes and fittings outside of chamber to be liquid epoxy coated to AWWA C210 and NSF 61 standards and wrapped with PVC tape to seal and protect pipe.

.2 Schedule 40 stainless steel pipe to 304L for potable water use on the spigots and standpipes.

.4 HDPE Pipe

.1 HDPE pipe shall be CTS Series 200 HDPE Municipal Tubing to AWWA C901-17.

.5 Joints:

.1 Polyvinyl chloride pipe joints to be bell and spigot joints with gaskets conforming to AWWA C111. Mechanical and flange joints with gaskets conforming to AWWA C111 to be used when specified or approved by Departmental Representative. Denso tape or approved equal to be applied to all mechanical joint fittings.

.2 Stainless steel pipe joints as per City of Calgary Specifications and AWWA C200

.6 Fittings:

.1 Polyvinyl chloride fitting to CAN 3-B.137.3, pressure class 150 with bell end joints and gaskets conforming to AWWA C111.

.2 Cast ductile iron fitting to AWWA C110 with bell end joints with gaskets conforming to AWWA C111. Mechanical and flange joints as specified or approved by Departmental Representative, with gaskets conforming to AWWA C111 and ANSI 303 stainless steel bolts, hex head nuts and washers conforming to ASTM A-3200.

.3 Stainless steel pipe fittings shall be as per City of Calgary Specifications and AWWA C207 Class D.

.4 Brass compression fittings to AWWA C800 with stainless steel insert stiffeners.

.2 Fire Hydrant

.1 Hydrant parts shall meet requirements as per section 503.02.07 of the City of Calgary waterworks construction standard specifications (latest edition), hydrants shall be ULC (Underwriter Laboratories of Canada), UL (Underwriter Laboratories, US) or FM (Factory Mutual Fire Insurance Company) approved and shall also conform to the AWWA C502-94 Standard.

.2 Hydrants shall be dry-barrel compression type supplied with an inlet elbow bell-end sized for 150 mm cast iron pipe O.D.

.3 Hydrants shall be supplied with a frangible (break-away) connection at the grade line flange.

.4 Hydrants shall be supplied with continuous, molded rubber-ring gaskets conforming to the AWWA C111- 00 Standard.

.5 Working pressure of 1034 kPa (150 psi).

.6 All hydrants shall have two (2) hose connections 57 mm (2 1/2") in size at 180 degrees with Alberta Mutual Thread and 114 mm (4 1/2") pumper connection to the following thread detail:

.1 4 threads per 25.4 mm

.2 154 mm O.D.

.3 Root 145 mm with 0.51 mm flat top and bottom

.7 The exterior of the hydrant above and 300 mm below the grade line flange shall be coated in accordance with Section 505.01.00 (Type C) in the following colour:

.8 Bright Green Body: C.I.L. #3486, Valspar 20-G-684,

2.2 TRACER WIRE

.1 Tracer wire shall be 10 AWG conductor, solid white, TWU flame seal wire, with Burndy KS-90, 16-10 connectors.

2.3 PIPE PROTECTION

.1 Cathodic Protection will be installed as per City of Calgary Specifications.

2.4 VALVES AND VALVE BOXES

.1 Gate valves to be resilient seat gate valves conforming to AWWA C509 and approved for potable water service.

.1 Working pressure 1034 kPa.

.2 Iron body, double disc or solid wedge with full 360E rubber to cast iron resilient seat. Resilient seat to be bonded or mechanically attached to gate and valve body.

.3 Valve interior to be epoxy coated for corrosion protection.

.4 Non-rising stem with O-ring seals.

.5 50 mm square operating nut.

.6 Valves to open counter-clockwise.

.7 Exterior to be factory coated.

.8 All exterior bolts and nuts must be T304 stainless steel.

.9 Valves in water bypass flow meter chamber to be painted oxford blue

.2 Cast ductile iron valve boxes to be bituminous coated three-piece screw down type, Norwood type B or approved equal.

.3 Bypass Meter Valves

.1 Valves to be stainless steel ball valves finished in oxford blue.

2.5 VALVE CHAMBERS

.1 Concrete to Section 03 30 00 - Cast-in-Place Concrete.

.2 Precast concrete sections to ASTM C478M. Cast ladder rungs integral with unit; field installation not permitted.

.3 Valve chamber frames and covers: grey iron castings, minimum tensile strength 200 MPa, with two coats, shop applied, approved asphalt coating with a mass of approximately 215 kg per set.

.1 Design and dimensions as indicated.

.2 Cover to be marked "WATER" / "EAU".

.4 Jointing materials:

.1 Manufacturer's rubber ring gaskets.

.2 Mastic joint filler.

.3 Cement mortar.

.4 Combination of above types.

.5 Mortar:

.1 Masonry cement to CAN/CSA-A3000.

.6 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CSA G30.18, hot-dipped galvanized after fabrication to ASTM A123 / A123M. Rungs to be safety pattern.

2.6 SERVICE CONNECTIONS / SAMPLING STATION (SPIGOT CONNECTION)

.1 Cross-linked polyethylene “PEX” Pipe to City of Calgary Construction Standards and ASTM F876, F877 and CAN3-B137.5.

.2 Brass corporation main stops: red brass to ASTM B62, having inlet threads to AWWA C800 and compression outlet. Mueller Oriseal H-15013, Cambridge 1-01440 Series 102 or approved equal

.3 Brass curb stops: red brass to ASTM B62 compression type. Mueller Mark 11 Oriseal stop and drain H-15219, Cambridge 709340 Series 1128 or approved equal. To be supplied complete with compatible curb stop chair. Inlet and outlet to have compression joint fittings for use with plastic or copper tubing.

.4 Water service saddles: AWWA C800 thread, nylon coated, ductile iron body, double stainless-steel strap for 38 mm and 50 mm.

.5 Service box for 25.4 mm or smaller curb stops: Mueller A726 or approved equal:

.1 Adjustable sliding top section, standard black iron pipe with threaded top.

.2 Top section to be 610 mm in length have a minimum 35.1 mm I.D. and a 10 mm set screw.

.3 1.0 to 2.0 m typical bury depth.

.4 Threaded steel cap with slotted top, 19mm pentagon brass plug.

.5 Casing – standard black iron pipe, 33.4 mm O.D.

.6 T-304 stainless steel rod, 12.7 mm diameter by 2.15 m long complete with standard pigtail for 25 mm I.D. pipe and welded bottom bracket with an 8 mm cored hole.

.7 Rod to be complete with a 6 mm diameter cotter pin a minimum of 55.2 mm long.

.8 Box bottom boot is to be cast or ductile iron, factory coated with a clear opening a minimum of 90 mm wide x 90 mm deep to allow curb stop access.

.9 The boot is to attach to the casing by means of a threaded joint.

.6 Service box for curb stops either 32 mm or 50 mm in size: Mueller A728 or approved equal:

.1 Adjustable sliding to section standard black iron pipe with threaded top.

.2 Top section to be 610 mm in length have a minimum 35.1 mm I.D. and a 10 mm set screw.

.3 1.0m to 2.0m typical bury depth.

.4 Threaded steel cap with slotted top, 19 mm pentagon brass plug.

.5 Casing – standard black iron pipe, 33.4 mm O.D.

.6 T-304 stainless steel rod, 12.7 mm diameter by 2.15 m long, attached to a manganese bronze clevis with a brass or stainless-steel rivet and standard pigtail for 25 mm I.D. pipe and welded bottom bracket with an 8 mm cored hole.

.7 Box bottom boot is to be cast or ductile iron, factory coated with a clear opening a minimum of 129 mm wide x 115 mm deep, to allow curb stop access.

.8 The boot is to attach to the casing by means of a threaded joint.

.7 Water spigot assembly shall be a WATTS self draining HY-800 non-freeze type yard hydrant (or approved equivalent) complete with connection to the 50mm cross-linked polyethylene PEX pipe below ground as shown on the detail drawings. Each location to include the following as per the contract drawings

.1 50mm Cross-linked polyethylene PEX pipe connection including corporation stop.

.2 WATTS self draining HY-800 non-freeze type yard hydrant (or approved equivalent).

.3 910 I.D. Type A Catch basin along with standard catch basin frame and grate as per these specifications the contract drawings

.4 Concrete pad surrounding catch basin and water spigot sloping to catchbasin and matching surrounding grade

.5 100mm x 100mm hollow steel square post encased in concrete, painted blue above grade,

.1 Waterline to be strapped to steel post

.6 Sign stating “POTABLE WATER” installed at top of post

.8 RV dump station will be Romort Water Tower Kit Part # 05400 by Romort or approved equal with shop drawings submitted for the tower assembly. The spigot assembly will include

.1 Spigot tower will be installed on a 250mm minimum thickness concrete pad as shown on the detail drawings or sanitary site servicing.

.2 Seasonal type tower will have connection above grade at base of spigot tower with hose bib connection

.3 Spigot tower closest to the sanitary dumping cap / inlet shall be painted red for sanitary splash pad rinsing as shown on the drawings.

.4 There will be a one-way check valve installed before the green spigot tower used for splash pad rinsing to prevent back flow into the potable water system.

.5 Spigot tower furthest from the sanitary splash pad shall be painted blue for potable water usage as shown on the drawings.

.6 Concrete splash pad and island:

.1 Built to the dimensions as shown on the design drawings with 10 bar reinforcement every 300mm each way.

.7 150mm diameter SDR35 sanitary sewer main complete with sweeping bend and all sanitary connections to the main required to connect.

.8 Foot operated cast iron drainage cap as shown on the drawings.

2.7 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to: Section 31 23 33.01 - Excavating, Trenching and Backfill

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

2.8 WATER BLOW OFF AND AIR RELEASE ASSEMBLY

.1 Air relief valve to be as per AWWA 512, Pratt Series WCV or approved equal

2.9 WATER METER CHAMBER FOR CANYON YOUTH CAMP

.1 The water meter bypass chamber consists of a 1800mm diameter concrete manhole

.2 Chamber exterior concrete surface shall be waterproofed in accordance with National Building Code Section 9.13 with “Xypex” waterproofing, or approved equal

.3 Chamber interior surfaces shall be painted with minimum one coat latex primer-sealer and two coats alkyd flat white finish.

.4 A pipe, flanges, fittings and valves as per these specifications and the drawings.

.5 NEPTUNE T-10 2 inch Pro Coder and flange connection set type water meter installed on 50mm water line

2.10 WATER DRAIN MANHOLE ASSEMBLY

.1 Drain manhole water assembly will consist of 50mm Cross-linked polyethylene PEX

.1 Connect to 200mm or 150mm diameter PVC watermain with a service saddle

.2 50 mm diameter curb stop as per the Contract Documents

.2 The water drywell chamber will consist of an 1200mm diameter 5A manhole as per City of Calgary Specifications

.1 The bottom half of the manhole barrel shall be 1200mm diameter perforated as shown on the design drawings

.2 40-75mm Drain rock as per AT specifications or approved equivalent

.3 Filter Fabric Typar 3401, Trevira 1120, or Amoco 4551 or approved equivalent

2.11 PIPE DISINFECTION

.1 Sodium hypochlorite, calcium hypochlorite or liquid chlorine to AWWA B300 or AWWA B301 to disinfect water mains

.2 Shall be conducted as per City of Calgary Standard for Testing and Disinfecting Water Mains.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials form site.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

.2 Trench alignment and depth as established by Departmental Representative.

.3 Do not back fill trenches until installed work has been inspected by the Departmental Representative.

3.4 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 directed by Departmental Representative.

.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.

3.5 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 100mm below bottom of pipe.

.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 95% Standard Proctor Maximum Dry Density to ASTM D698.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling with compacted bedding material.

3.6 PIPE INSTALLATION

.1 Steel pipe shall be handled and placed using wide slings and padded cradles of canvas, leather or other suitable material to prevent damage to pipe and coating.

.2 Coated steel pipe shall be supported on sandbags or suitable fabric wrapped wooden blocks. When it is necessary to walk on coated pipe, soft-soled shoes shall be used. The use of bare metal cables, chains, hooks or other equipment that may cause damage to coatings will not be permitted.

.3 Lay PVC, Cross-linked polyethylene PEX and HDPE pipes to manufacturer's standard instructions and specifications and City of Calgary installation standards.

.4 Join pipes in accordance with manufacturer's recommendations. Apply a minimum amount of pipe lubricant only to the beveled end of the pipe spigot.

.5 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.6 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Remove and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows undue settlement after installation

.7 Face bell ends of pipe upstream.

.8 Do not exceed permissible deflection at joints or bending through length of pipe as recommended by pipe manufacturer.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes with equipment and methods approved by the Departmental Representative. The use of excavator or backhoe buckets for pipe connection shall "NOT" be permitted.

.11 Cut pipes in an 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.

.12 Align pipes carefully before jointing.

.13 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.

.14 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.15 Complete each joint before laying next length of pipe.

.16 Minimize deflection after joint has been made.

.17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative

.19 When work stoppage occurs, block pipes in an approved manner to prevent creep during down time.

.20 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.21 Do not lay pipe on frozen bedding.

.22 Protect valves and appurtenances from freezing.

.23 PVC, cross-linked polyethylene PEX and Steel Pipe Installation to be done in accordance with City of Calgary Specifications.

.24 Upon completion of pipe laying and after Departmental Representative has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed by Departmental Representative.

3.7 TRACER WIRE

.1 All pipes including mains, services, leads and forcemains shall include tracer wire. Splices shall be accomplished using manufactured connectors completely encased with "Duxseal" manufactured by Appleton Electric Limited or approved equal. Tracer wire shall be laid immediately alongside and at the bottom of the new watermain and all 50mm cross-linked polyethylene PEX service leads. Wire shall be continuous up and through all mainline valve boxes and 50mm service / spigot and drain manhole valves and shall be rolled into a coil immediately below the valve box caps.

3.8 VALVE AND FITTING INSTALLATION

.1 Install valves and fittings to manufacturer's recommendations at locations indicated.

.2 Support valves located in valve boxes or valve chambers by means of preserved wood blocks located between valve and solid ground.

.3 All subsurface bolted connections in contact with the soil shall be stainless steel and wrapped in Denso-tape.

.4 All fittings that require concrete thrust blocks shall be wrapped in plastic to avoid concrete coming into direct contact with pipe or fittings

.5 Bevel or taper ends of PVC pipe to match fittings.

.6 Install underground post-type indicator valves as indicated.

3.9 VALVE CHAMBERS

.1 Use precast units as approved by Departmental Representative.

.2 Construct units as indicated, plumb and centred over valve nut, true to alignment and grade, and not resting on pipe.

.3 Place reinforcing steel and miscellaneous metals required to be embedded in concrete to details indicated and in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.4 Cast bottom slabs for precast units directly on undisturbed ground with a minimum of 150mm of compacted granular bedding.

.5 Set bottom section of precast unit in bed of cement mortar and bond to bottom slab.

.1 Make each successive joint watertight with approved rubber ring gaskets, mastic joint filler, cement mortar, or combination thereof.

.6 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.

.7 Plug lifting holes with precast concrete plugs set in cement mortar.

.8 Set frame and cover to required elevation of at least one 50mm concrete ring.

.9 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.

.10 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

3.10 SERVICE CONNECTIONS / SAMPLING STATION (SPIGOT CONNECTION)

.1 Tapping of main: Direct tapping of PVC water main shall be in strict compliance with procedures recommended by the Uni-Bell Plastic Pipe Association, AWWA C900 and AWWA C905. Use tapping machine to drill, tap and thread corporation stop into main. Wherever possible tap main under pressure and use special care to prevent cuttings from falling into main. Tapping a service line larger than 25mm requires use of service clamps. Construct service connections at right angles to water main unless otherwise directed. Locate curb stop at location shown on drawings.

.2 Employ only competent workmen equipped with suitable tools to carry out tapping of mains.

.3 Tap main at 10:00 o'clock or 2:00 o'clock position only, not closer to a joint not closer to adjacent service connections than recommended by manufacturer or 1 m whichever is greater.

.4 Leave corporation stop valves fully open.

.5 In order to relieve strain on connections, install service pipe in goose nick form laid over into horizontal position to the right facing the main. Service to be snaked in trench

.6 Where pipe is to be installed between curb box and an existing or proposed building, the pipe shall be laid so that it will drain from the building to the curb box. The building end of the pipe shall be crimped.

.7 Install curb stop on service 50 mm or less in diameter. Leave curb stop valves fully closed. In fine grained or clay soils a drainage sump 0.05m³ in volume shall be placed below and around the curb stop and filled with washed rounded pea sized rock.

.8 Install service box, set plumb and adjust upper section to design grade elevation. The lower section of the service box and the extension rod shall be a minimum of 250mm below ground elevation and tighten set screw securely.

.9 At the water standpipe assembly, cross-linked polyethylene PEX pipe shall have bends installed in accordance with manufacturer's recommendation.

.1 100 mm x 100 mm hollow square steel post to be installed in ground at least 1.0 metre, encased in concrete and will extend 1.250 metres above grade.

.2 Cross-linked polyethylene 25mm PEX pipe to extend 900mm above finished grade with reducer to 12.5mm at least, strapped to 100mm x 100mm steel post at least every 300mm.

.3 Cross-linked polyethylene PEX pipe will transition using approved fittings from 50mm below ground to connect to the WATTS self draining HY-800 non-freeze type yard hydrant (or approved equivalent).

.4 Type A precast 910mm precast concrete barrel to be installed as shown on design drawings.

.10 Water RV Spigot Tower to be installed in concrete base using anchors as recommended by manufacture

.1 Concrete base to be 150mm above finished asphalt grades.

.2 Valve arrangement to be installed as shown on the design drawings.

.3 Concrete splash pad to be installed with drainage to centre with a minimum 25mm lip around the entire edge.

.4 Cast iron cover, with removable lid, to be cast into concrete to cover 150mm PVC sewer pipe.

.11 Connect to existing washroom building plumbing with appropriate adapter.

3.11 WATER BLOW OFF AND AIR RELEASE ASSEMBLY

.1 Install air relief valves as per manufactures recommendation.

.2 Maintain 500 mm space between top of air valves and chamber ceilings.

.3 Pipe to be supported through air relief valve chamber.

.1 No pipe joints within 0.5 m of each side of the chamber.

.4 Chamber to be protected from flooding and adjusted to appropriate grade.

3.12 WATER METER CHAMBER FOR CANYON YOUTH CAMP

.1 Meter chamber assembly as per design drawings.

3.13 THRUST BLOCKS AND RESTRAINED JOINTS

.1 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, and fittings and undisturbed ground as indicated in City of Calgary Specifications (Current edition).

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within 24 hours after placing.

3.14 FIRE HYDRANTS

.1 Install hydrants at the location indicated on the drawings and with the approval of the departemental representative.

.2 Install hydrants in accordance with City of Calgary waterworks construction standard specifications (latest edition).

.3 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated.

.4 Set hydrants plum with hose outlets parallel with edge of pavement or road shoulder with pumper connection facing roadway and with body flange set at elevation of 50-250 mm above final grade.

.5 If hydrant extensions are needed to get to finish grade, all extensions required will be considered incidental to the hydrant cost and supplied and installed to City of Calgary and manufacturers specifications.

.6 Ensure drain plug is installed.

.7 Hydrants may be used for pressure testing, disinfection and flushing of water mains. They must be operated in full open position only. To restrict flow, attach a secondary valve to hydrant nozzle.

3.15 HYDROSTATIC AND LEAKAGE TESTING

.1 Provide labor, equipment and materials required to perform hydrostatic and leakage tests hereinafter described. This may include (but not limited too) the supply of a generator to run the raw water well pump, treatment of the raw water in order to fill the reservoir with potable water and usage of this water in the reservoir for leak testing. Alternatively, the contractor can provide potable water to use for leak testing from off site sources. It will be required that the reservoir, chlorination system and subsequent pumps all be tested to ensure they are in working order.

.2 Notify Departmental Representative at least 24 hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.

.3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five (5) days after placing concrete or two days if high early strength concrete is used.

.4 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Departmental Representative.

.5 Test pipeline including service connections after all backfilling is complete.

.6 Open valves within test section and test section in accordance to the City of Calgary's Standard for Testing and Disinfecting Water Mains.

.7 Expel air from main by slowly filling main with potable water. Install corporation stops where required to expel air at high points, or to flush dead ends in main, as directed by Departmental Representative. Close stops after satisfactory completion of test. Air pressure testing of installed PVC pressure pipe is expressly prohibited for safety reasons.

.8 Apply hydrostatic test pressure of 1035 kPa or 1.5 times the normal operating pressure based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of two (2) hours.

.9 Relieve hydrostatic pressure on each section of pipeline segment at the end of the test period.

.10 Define leakage as amount of water supplied in order to maintain test pressure for two (2) hours.

.11 Do not exceed allowable leakage as defined in AWWA C600-82 using the following formula:

For PVC: $L = \frac{N \times D \times \sqrt{P}}{7400}$

P – test pressure (psi) (1.0 PSI – 6.9 kPa)

D – nominal diameter (inches)

N – number of mechanical joints

L – leakage (gpm)

.12 Locate and repair defect is leakage is greater than amount specified.

.13 Repeat test until leakage is within specified allowance for full length of water main.

.14 When testing is done during freezing weather, protect valves, joints and fittings from freezing.

.15 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

3.16 PIPE SURROUND

.1 As per Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.17 BACKFILL

.1 As per Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.18 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations shall be witnessed by the Departmental Representative. Notify the Departmental Representative at least 24 hours before the proposed date when disinfection will commence.

.2 Provide connections, generators, water trucks/tanks and pumps as required.

.3 Flush, disinfect and bacterial test all water mains, stubs longer than 6m, to AWWA C651. The point of application shall be at or near the beginning of the pipe the extension and the discharge shall be at or near the end of the line being treated. Hydrants shall not be used for point of application of sodium hypochlorite or liquid chlorine.

.4 Sections shorter than 6 m for tie-in's shall be disinfected to AWWA C652 to a dose not less than 200 ppm.

.5 Upon acceptance of disinfection by the Departmental Representative, flushing may proceed. PCA is to be notified when flushing with distribution system water is scheduled to commence. Flushing may be limited to off peak hours. Flushing is to be de-chlorinated and directed to the storm sewer and continue until all heavily chlorinated water, pipe lubricant or other materials that may have entered the main during construction have been expelled. A drawing detailing the proposed flushing sequence and valving required is to be approved by the Departmental Representative before commencement of flushing. This drawing shall be provided to the city public works water distribution lead operator prior to the flushing.

.6 Dechlorination of the chlorinated water is required before discharging the water to the environment in order to meet the regulatory requirements of the Alberta Environmental Protection. Dechlorination, is to be performed by adding neutralizing chemicals (AWWA C651, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

.7 After final flushing, the Departmental Representative will allow 12 hours to pass before collecting water samples for bacteriological testing. The water main is to be flushed for not more than five (5) minutes before taking the sample. One sample is to be taken from each leg of the water main, stubs longer than 6 m.

.8 Bacteriological samples are to be collected by the Departmental Representative in approved sample bottles obtained for the Provincial Laboratory of Public Health or the local Health Unit. The sample bottles are sterilized and contain a dechlorination reagent. Never rinse sample bottle before testing. The locations where each sample is taken must be clearly identified on the form, PH 108, provided with each sample bottle. Indicate the sample is from the newly constructed water main, the public works water distribution lead operator is to be provided with a drawing showing the location each sample is drawn from and the corresponding identification number from the public health form PH 108. This drawing must indicate the water main tested by each sample.

.9 No new water main will be put into service until all excess pipe lubricant has been flushed from the main and the results of the bacteriological tests have been provided to

the Departmental Representative stating the water is free from contamination. These results may be delivered to the Departmental Representative or faxed. Once satisfactory water quality and bacteriological test results have been confirmed, the contractor will commission the new water main.

.10 If the initial disinfection fails to produce satisfactory bacteriological samples, the mains may be reflushed and re-sampled. If check samples show the presence of coliform organisms, then the water main shall be rechlorinated and flushed until satisfactory results are obtained.

.11 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.12 Upon successful commissioning and test reporting of any works completed under this contract the contractor will assist PCA with decommissioning of the installed watermain for the winter months including the full drainage and winterization of the potable water system.

3.19 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as detailed in these specifications.

END OF SECTION

33 16 00 WATER UTILITY STORAGE TANKS

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of the Potable Water Reservoir and all associated appurtenances, instrumentation, piping, valves, and fittings as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

.2 The Contractor shall supply, install and test all equipment and piping necessary to properly and fully complete the operating systems as specified herein and as shown on drawings, unless otherwise indicated. All materials, labour, tools and appliances necessary for this work shall be furnished by the Contractor. This may include (but not limited too) the supply of a generator to run the raw water well pump, treatment of the raw water in order to fill the reservoir so that pumps, treatment and alarms can all be tested to ensure they are in working order, followed by the winterization of the utility storage tanks.

1.2 REFERENCES

.1 American National Standards Institute / American Water Works Association (ANSI/AWWA)

- .1 ANSI/AWWA B300-[10] , Standard for Hypochlorites.
- .2 ANSI/AWWA C110-[12] , Ductile-Iron And Gray-Iron Fittings.
- .3 ANSI/AWWA C210-[15] , Liquid Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
- .4 ANSI/AWWA C651-[05] , Standard for Disinfecting Water Mains.
- .5 ANSI/AWWA C652-[11] , Disinfection Of Water Storage Facilities.
- .6 ANSI/AWWA C800-[14] , Underground Service Line Valves & Fittings.
- .7 ANSI/AWWA D100-[11] , Welded Carbon Steel Tanks For Water Storage.
- .8 ANSI/AWWA D102-[17] , Coating Steel Water-Storage Tanks.

.2 American Society of Mechanical Engineers (ASME)

- .1 B1.2-[17] , Gages And Gaging For Unified Screw Threads.
- .2 B16.5-[17] , Pipe Flanges And Flanged Fittings.

.3 American Society for Testing and Materials International, (ASTM)

- .1 ASTM A53 / A53M-[18] , Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .2 A105 / A105M-[18] , Standard Specification for Carbon Steel Forgings for Piping Applications.
- .3 A182 / A182M-[19a] , Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
- .4 A193 / A193M-[19] , Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

.5 A194 / A194M-[18] , Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

.6 A234 / A234M-[19] , Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.7 ASTM A276 / A276M-[17] , Standard Specification for Stainless Steel Bars and Shapes.

.8 A312 / A312M-[19] , Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.9 ASTM A351 / A351M-[18e1] , Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.

.10 A449-[14] , Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120 / 105 / 90 ksi Minimum Tensile Strength, General Use.

.11 A536-[84(2019)e1] , Standard Specification for Ductile Iron Castings.

.12 B633-[19] , Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

.13 C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.14 D1622 / D1622M-14, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.15 D2564-[12(2018)] , Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

.16 D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.17 D6226-15, Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

.18 F593-[17] , Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.4 Canadian Standards Association (CSA)

.1 CSA B1.1-[49] , Manual of Unified Screw Threads for Shop And Drafting Room.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Supply, outfitting, and installation of the potable water tank and appurtenances:

.1 Measure for payment for the packaged potable water tank and appurtenances constructed offsite shall be Lump Sum, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Potable Water Reservoir: Tank and Appurtenances"** and the price(s) bid shall be full compensation for the cost of transport to site and furnishing all labour, materials, equipment, tools and incidentals not included in item 1.3.2 necessary to install and complete the work as specified in the Contract Documents.

.2 Supply and installation of the Potable Water Reservoir instrumentation, piping, fittings, and valves:

.1 Measure for payment for the instrumentation, piping, fittings, and valves shall be Lump Sum, in accordance with the Contract Document or as directed by the Departmental Representative.

.2 Payment shall be made under "**Potable Water Reservoir: Instrumentation, Piping, Fittings, and Valves"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work onsite as specified in the Contract Documents.

.3 Items considered incidental on Item 1.3.1 to the Work include, but are not limited to:

.1 Supply and installation of the Potable Water Reservoir including all appurtenances, instrumentation, piping, fittings, and valves.

.2 Connection of the Potable Water Reservoir to associated subgrade water and electrical lines.

.3 Disinfection and flushing of the Potable Water Reservoir and any equipment in contact with the potable water.

.4 Startup and commissioning.

.5 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.4 Traffic Control and transport requirements for this Work shall be incidental to "Traffic Accommodation" and no separate payment will be made to the Contractor.

.5 Mobilization and demobilization required for this Work shall be incidental to "Mobilization / Demobilization".

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and datasheets for all associated components of the Potable Water Reservoir, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit tank drawings stamped and signed by a Professional Engineer registered or licensed in Alberta, Canada.

.2 Tank to be suitable for local climate data and include all foundation, erection and installation details such that a complete tank package is provided.

.4 Samples:

.1 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 2 weeks minimum prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

.5 Closeout Submittals:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit record drawings, including directions for operating the tank, list of equipment required to operate the tank, and details of the materials.

.3 Operation and Maintenance Data: submit operation and maintenance data for incorporation into the manual.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.7 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 All equipment shall be adequately protected from damage during handling and from dust, dampness or any other injurious substance during delivery to the site, while at the site and after construction. Any damage which may occur during handling, shipping, or installation shall be made good by the Contractor at his expense. Equipment stored in unheated or open areas on the site shall be covered and provided with thermostatically controlled heaters of sufficient size to keep temperature of the equipment above the dew point.

.2 Storage areas shall be made accessible to the Departmental Representative at any time for the determination of the condition of storage.

1.8 INSPECTION

.1 The Departmental Representative reserves the right to inspect and test any material to be supplied under this specification at the manufacturer's plant or after arrival at the location specified for delivery. All materials, components, or parts which do not meet these specifications, the standards, or are defective, shall be replaced by the Contractor at his expense to the satisfaction of the Departmental Representative.

Part 2 Products

2.1 SUBSTITUTIONS

.1 Supply approved equipment exactly as indicated by the drawings and specifications. Alternate materials may be substituted by the Contractor only if such substitutions have been approved in writing by the Departmental Representative.

.1 Glass fused to steel bolted tanks designed to AWWA D103 are acceptable alternative products.

2.2 POTABLE WATER TANK

.1 The tank shall have a minimum water capacity of 133 m3 with 0.3-0.6 m of freeboard above the full water line. The full water line shall be a minimum of 5.3 m above the base of the tank. The tank shall be capable of holding water with zero freeboard.

.2 All components in contact with potable water are to be NSF 61 certified.

.3 The tank shall be an epoxy coated modified API tank or approved equal. The tank shall be designed to AWWA D100 or API and stamped by a Professional Engineer registered in Alberta.

.4 The tank is for summer use only; it must be capable of being drained for winter.

.5 Additional tank appurtenances include:

.1 External tank ladder with an OSHA fall protection cage and lockable access gate. Cage is to begin 2.2 m from the bottom of the tank.

.2 100 mm roof vent with:

.1 Two 90° elbows.

.2 Insect / bird screen welded to the outlet: Valmatic Vent Safe or approved equal.

.3 Class 150# SOFF flange and backup ring.

.4 3.2 mm (1 / 8") red rubber gasket.

.6 Min. 610Ø lockable access hatch installed beside level float connections and in front of access ladder.

.7 Two shell manholes on opposing sides of the tank, each having a minimum diameter of 610 mm.

2.3 PIPING VALVES AND FITTINGS

.1 Piping welded to tank shall be ASTM A53 GRB SCH40S and ASTM A234 / 105(N) WPB, schedule to match pipe. Flanges shall ASTM A105N slip on, flat face to ASME B16.5 Class 150#.

.2 Piping running down the side of the tank shall be ASTM A312 TP304 SCH40S with 3.2 mm (1 / 8") rubber isolation between tank and stainless steel.

.3 Fittings shall be ASTM A182 F304. Schedule to match pipe. Bore or grooved fittings shall be Victaulic stainless steel (as specified above) or Victualic ASTM A536, grade 65-45-12 ductile iron, epoxy coated.

.4 Couplings shall be flexible or rigid type shown on the contract drawings, ASTM A536 grade 65-45-12 ductile iron or epoxy coated complete with EHP or EPDM gasket. Track bolts and nuts shall be ASTM F593, group 2, condition CW meeting the requirements of F594, Group 2, condition CW with anti-galling reducing coating. Victaulic approved.

.5 Flanges shall be ASTM A536 grade 65-45-12 ductile iron, epoxy coated with EPDM gasket. Track bolts and nut shall be ASTM A449 meeting ASTM A563 GRB and zinc electroplated to ASTM B633 ZN / EN5, finish III. Victaulic 741 approved.

.6 Flange assembly hardware shall be ASTM A193-B8 studs with two ASTM A194-8 nuts. Anti-seize lubricant shall be applied to all stainless threads. Threads shall be CSA B.1.1 coarse thread series, class 2 fit. Stud bolt length shall extend at least 2 threads past the nut but not exceeding 12 mm. Bolts shall be torqued to Victaulic specifications or ASME PCC-1 for conventional gaskets.

.7 All connections shall be grooved to Victaulic's specifications.

.8 Inlet:

.1 50Ø potable water inlet to enter the tank near the tank bottom and run up along the side of the tank as shown in the drawings. Inlet piping supports are to be welded to tank prior to tank coating.

.2 Potable water inlet discharge to be above the full water line and constructed with 3 - 90° elbows with water spraying against the tank wall. There is to be a 50 mm spacing between the inlet piping elbow and tank wall. Fabricator to weld in place.

.3 50Ø flexible couplings to be added in series between the riser and tank inlet for ground settlement / frost heaving as shown on Contract Documents. Victaulic No. 177 or approved equal.

.4 50Ø CTS AWWA C800 Brass NPTxComp fitting for connection to HDPE with stainless steel stiffener.

.9 Outlet:

.1 100Ø flexible couplings to be added in series between the riser and tank inlet for ground settlement / frost heaving: Victaulic No. 177 or approved equal.

.2 Flange adaptor to be 100Ø Victaulic 741 or equivalent and AWWA C110 DI cement lined Tyton joint by #125 flange.

.3 Check valve shall be duel disk lug ASTM A351 GRCF8M body, seat, disc and cap with ASTM A276 GR316 shaft and pin. Spring shall be Inconel X-750, soft seated with Buna-N and a pressure rating of 275 psi. The valve shall be Titan CV42L-55 or approved equal.

.4 Ball valves shall be self seated and constructed from ASTM A351 GRCF8M or ASTM A276 GR316 with RTFE seat. Operator shall be leaver with a minimum 200 psi working pressure. Victaulic 7265 or approved equal.

.5 Camlock connections shall be male x NPT, 304 / 316 stainless steel for temporary pump connection. Include female cap with lock / car seal.

2.4 INSULATION AND THAWING CABLE

.1 The pipe shall be insulated using half shells by Urecon, Thermacor or Shaw Pipe with the following properties:

.1 Insulation Material: Rigid polyurethane foam with two-part polyurethane waterproofing coating.

.1 Thickness: Insulation 50mm (2in.), Polymer as recommended by the manufacturer.

.2 Density: (ASTM D1622) 35 to 48 kg/m^3 (2.2 to 3.0 lbs/ft^3).

.3 Closed cell content: (ASTM D6226) 90%, minimum.

.4 Water absorption: (ASTM D2842) maximum 4.0% by volume.

.5 Thermal Conductivity: (ASTM C518) 0.020 to 0.025 W/m°C (0.14 to 0.17 Btu * in/ft^2 * hr *°F)

.6 Temperature range: Cryogenic to 93.3°C (200°F)

.2 Jacket Material: Aluminum or 304 / 316 Stainless Steel.

.1 18-24 Gauge thickness

.2 Min. 50mm overlap with overlap to encourage water shedding

.3 304 / 316 Stainless steel gear clamps, every 300mm

.2 Pipe joints or fittings or valves shall be completed using factory formed half shells with valve operator extensions to ensure insulation thickness is maintained while allowing valve operation without removing insulation.

.3 Insulation shall be applied to all aboveground water piping and extend to 1.5m depth burial.

.4 Thawing cable:

.1 6 W/ft, 120V, 60hz, single phase, capable of running on a 15A breaker and appropriate for wet environment.

.2 End connection shall be Ground Fault Protected standard receptacle with a maximum length of 1.2m or as supplied by the manufacturer. Unit shall be outdoor, weatherproof rated. Running of the thawing cable will be by portable generator.

.3 Raychem H908 end connection with WinterGard Wet H612 cable or equal.

2.5 FLOATS

.1 "On" float to connect to the well and treatment system such that these are activated when the tank reaches 75% capacity.

.2 "Off" float to connect to the well and treatment system such that these are turned off when the tank reaches full capacity (below the 0.3-0.6 m freeboard mark).

.3 Two alarm floats shall be installed for high and low alarm.

.4 Floats to be set for height using suitable strain relief fittings. Wiring shall be protected from wildfire flame.

.5 Floats to be NSF61 approved. Level float connections to be threadolets. Threadolets and mounting bracket for the junction box are to be welded to the tank prior to coating. Floats to be SJE Rhombus Milliampmaster WPS or approved equal.

2.6 DISINFECTION PRODUCT

.1 Liquid sodium hypochlorite to AWWA B300 to disinfect Potable Water Reservoir.

.2 Shall be conducted as per AWWA C652, newest edition.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials form site.

3.2 COATINGS

.1 Coatings shall be applied to all metal surfaces, with the exception of corrosion resistant materials, such as stainless steel, copper or brass.

.2 Water immersed:

.1 Applied to: wall penetrations and inside of piping, valves, and fittings.

.2 Coating system shall be suitable for exposure in immersed environments at ambient temperatures. The coating shall be compliant with AWWA C210 / D102, NSF 61 and approved for the proposed pipe / tank size. All surfaces should be assessed and treated in accordance with ISO 8504. Oil or grease shall be removed per SSPC-SP-1 solvent cleaning.

.3 Immersed surfaces shall be surface prepared to SSPC-SP-10 near white blast. If oxidation has occurred between blasting and application, the surface shall be reblasted to the specified visual standard. Surface defects revealed by the blast cleaning process, shall be ground, filled, or treated in the appropriate manner.

.4 Immediately following surface preparation, a prime coat of 2-component, owner selected colored high build epoxy shall be applied by spray to the paint manufacture's recommendations.

.5 This shall be followed by a final coat of 2-component, applied by spray to the paint manufacture's recommendations. Color selected by the owner.

.6 Grooved end piping and fittings shall be internally coated for immersed service, as well as on the outer gasket sealing band between each pipe groove and the end of the pipe or fitting.

.7 Flexible rubber jacketed cables, liquid tight flexible conduit, nameplates, brass / copper, aluminium and stainless steel components and valve internals shall not be painted.

.3 Dry Exterior

.1 Applied to: outside of all valve bodies, outside of piping and fittings, and supporting sub-frame(s).

.2 Coating system shall be high durability (15+ year) rated, AWWA C210 and suitable for a classification C2 low corrosively environment per ISO Standard 12944. All surfaces should be assessed and treated in accordance with ISO 8504. Oil or grease shall be removed per SSPC-SP-1 solvent cleaning.

.3 Surface prepare to SSPC-SP-6 commercial blast. If oxidation has occurred between blasting and application, the surface shall be reblasted to the specified visual standard. Surface defects revealed by the blast cleaning process, shall be ground, filled, or treated in the appropriate manner. Hold point for NACE inspector to approve prior prime coating, schedule inspector to minimize hold time to minutes.

.4 Immediately following surface preparation a prime coat of 2-component, primer grey coloured epoxy anti-corrosive primer shall be applied by spray to the paint manufacture's recommendations.

.5 This shall be followed by a final coat of 2-component, owner selected colour epoxy applied by spray to the paint manufacture's recommendations.

.6 Flexible rubber jacketed cables, liquid tight flexible conduit, nameplates, brass / copper, aluminium and stainless steel components shall not be painted.

.4 Application Quality

.1 The Supplier shall be responsible for self-inspection of the coating systems as outlined, but subject to independent inspection at all times.

.2 Only an approved NACE applicator shall be utilized for surface preparation and coating systems. The NACE certified coating inspector shall, through the Contractor, provide the Departmental Representative with a letter of verification upon completion of all required coating applications.

.5 Field Touch Up Procedures

.1 Damage to shop applied coatings occurring in storage, erection or installation shall be repaired to standards equal to project specifications.

.2 Immediately prior to repairing damaged or unpainted surfaces, and before the specified surface preparation is carried out, all grease, oil, dirt, and foreign matter shall be removed as per SSPC SP1.

.3 Edges of sound remaining coating on the surface shall be feathered by sanding / grinding prior to painting.

.4 Gloss paint surfaces shall be sanded or abraded to provide a bond for successive coats.

.5 The minimum coating requirements for spot coating repairs shall be as follows:

.1 No corrosion primer exposed: Apply one or more finish coats to restore specified film-thickness.

.2 No corrosion primer damaged: Clean area to substrate and reapply the specified system.

.3 Rusted areas: After cleaning to the original standard of surface cleanliness, reapply specified system.

.6 All areas to be repaired shall be inspected by the coating inspector before, during and after such repairs to confirm compliance with the foregoing and/or the project specifications.

3.3 PIPE INSTALLATION

.1 Assemble piping using fittings manufactured to ANSI or AWWA standards.

.2 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.3 The types and sizes of pipes to be used shall be as specified and shown. Where sizes of small pipe are omitted from the drawings and not mentioned in the specifications, the sizes to be used shall correspond to the latest addition of AWWA.

.4 All pipe shall be carefully placed and supported at the proper lines and grades, and where possible shall be sloped to permit complete drainage. Piping runs shown on the drawings shall be followed as closely as possible, except for minor adjustments to avoid architectural and structural features. If major relocations are requested, they shall be submitted to the Departmental Representative for approval.

.5 In erecting the pipe a sufficient number of threaded unions, grooved end or flanged end type joints shall be used to allow any section or run of pipe to be disconnected without taking down adjacent runs. The provision of an adequate number of appropriate take-down fittings must be rigidly adhered to whether or not such fittings are indicated on the drawings. Take-down fittings shall also be provided for removal of valves and other appurtenances.

.6 Wherever a metallic nonferrous pipe or appurtenances is connected to a ferrous pipe or appurtenance, dielectric unions of an acceptable type shall be used to insulate pipe sections. Wherever copper pipe is supported from hangers, it shall be suitably insulated from the hangers.

.7 The interior of all piping shall be cleaned after assembly and before connecting to equipment.

.8 Pipes shall be installed in accordance with the manufacturers instructions and insulated where shown as per the Contract drawings. Factory formed insulation half shells shall be

sized to fit the thawing cables under the insulation, and around all valve shapes. Pipe supports shall be attached to the final outside jacket to minimize thermal bridging.

.9 Thawing cables shall be handled and installed in accordance with the manufacturer's instructions.

.1 The thawing cables shall be installed in a spiral around the pipe / valves in all installation orientations as the cable is intended to thaw the frozen pipe rather than the heat tracing. Additional cable length shall be placed around areas near areas without insulation or valves. Obtain approval from the Departmental Representative prior to covering thawing cables with insulation.

.2 The Contractor shall adhere to the minimum length of cable per length of pipe ratio recommended by the manufacturer for thawing purposes.

.3 Thawing cable end connections shall be at a convenient location for generator connection and confirmed with the Departmental Representative during construction.

.10 Pipe supports:

.1 Piping shall be properly supported vertically and horizontally by wall brackets, pipe hangers and pipe support. Unless otherwise specified, supports for all horizontal runs of all sizes or pipe shall be spaced in accordance with good practice.

.2 The Contractor shall provide special pipe supports where required.

.11 Pipe cutting:

.1 The Contractor shall perform all work of cutting pipe and fittings or special castings necessary to the proper and accurate assembly, erection and completion of the work. All pipe shall be cut to fit accurately with smooth edges and faces.

.12 Pipe threads:

.1 Pipe ends shall be reamed to a full bore of the pipe. Threads shall conform in dimension and limits of size to ASME B1.2, taper jointing thread. In making up threaded joints, an accepted thread lubricant shall be applied to the male threads only.

.13 Flanged joints:

.1 Flanged joints shall be made up square with even pressure upon the gaskets and shall be perfectly watertight.

.14 Pipe Grooving:

.1 Manufacture of grooved end products must provide start-up training to contractor and provide as required field / shop "hands-on" field support during construction.

.15 Steel pipe joining by welding:

.1 Not permitted unless indicated on the contract drawings.

.16 Install in accordance with NPC, AWWA / API, and local authority having jurisdiction.

.17 Lay pipes to manufacturer's standard instructions and specifications.

.18 Join pipes in accordance with manufacturer's recommendations.

.19 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.20 Do not exceed permissible deflection at joints or bending through length of pipe as recommended by pipe manufacturer.

.21 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.22 Cut pipes in an 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.

.23 Align pipes carefully before jointing.

.24 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.

.25 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.26 Complete each joint before laying next length of pipe.

.27 Minimize deflection after joint has been made.

.28 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.29 When work stoppage occurs, block pipes in an approved manner to prevent creep during down time.

.30 Protect valves and appurtenances from freezing.

3.4 VALVE AND FITTING INSTALLATION

.1 Install valves and fittings to manufacturer's recommendations at locations indicated.

.2 Piping, valves, and fittings shall be properly supported by supports as shown on the drawings. Location and configuration of supports is as shown on the drawings and described in these specifications. A 6 mm thick pad of hard neoprene rubber shall be placed between the pipe and its supports to ensure freedom of lateral movement.

.3 Valves shall be installed to the details shown on the drawings. The interior and exterior of flanged valves shall be thoroughly cleaned and any rust deposits or foreign matter on the valve flanges shall be removed before the valves are installed.

.4 Tank Testing

.5 Inspection, testing and repairs shall be done to AWWA D100 or API, newest edition. Submit records in writing certifying the tank for compliance by a professional engineer and NACE inspector.

Part 4 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations shall be witnessed by the Departmental Representative. Notify the Departmental Representative at least 24 hours before the proposed date when disinfection will commence.

.2 Provide connections, generators for power supply and pumps as required to undertake all testing, commissioning and de-commissioning requirements.

.3 The Reservoir shall be filled with concentrated chlorine solution via the chlorine metering pump in the Water Treatment Plant as outlined in Section 4.1 AWWA C652, newest edition. The concentrated chlorine solution will be retained in the Potable Water Reservoir for an appropriate retention time as per AWWA C652, newest edition.

.4 After the retention period the free chlorine residual in the storage system shall be adjusted until an appropriate concentration is reached such that this water can be used for disinfecting the distribution system according to AWWA C651 and Section 33 14 16 – Site Water Utility Distribution Piping.

.5 Dechlorination of the chlorinated water is required before discharging the water to the environment in order to meet the regulatory requirements of the Alberta Environmental Protection. Dechlorination, is to be performed by adding neutralizing chemicals (AWWA C652, Appendix B, newest edition) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

.6 After disinfection, the Reservoir and distribution system shall be flushed until an appropriate chlorine concentration is reached as per AWWA C652, AWWA C651, and Section 33 14 16 – Site Water Utility Distribution Piping.

.7 After disinfection and flushing but before the Reservoir is put into service, samples are to be collected and tested for bacteriological content and odour as per AWWA C652.

.8 Bacteriological samples are to be collected by the Departmental Representative in approved sample bottles obtained for the Provincial Laboratory of Public Health or the local Health Unit. The sample bottles are sterilized and contain a dechlorination reagent. Never rinse sample bottle before testing. The locations where each sample is taken must be clearly identified on the form, PH 108, provided with each sample bottle. Indicate the sample is from the new Potable Water Reservoir, the Departmental Representative is to provide a drawing showing the location each sample is drawn from and the corresponding identification number from the public health form PH 108.

.9 The Potable Water Reservoir will not be put into service until the results of the bacteriological tests have been provided to the Departmental Representative stating the water is free from contamination. Once satisfactory water quality and bacteriological test results have been confirmed, the contractor will commission the new Potable Water Reservoir.

.10 If the initial disinfection fails to produce satisfactory bacteriological samples, the Reservoir may be rechlorinated and re-sampled.

.11 Upon successful commissioning and test reporting of any works completed under this contract the contractor will assist PCA with system draining and winterization of the reservoir for the winter months.

END OF SECTION

33 21 00 WATER SUPPLY WELLS

Part 1 General

1.1 DESCRIPTION

.1 Drilling of one test well and one production water well with desired yield a minimum of 66.5 m3/day but targeting 166 m3/day extending to an assumed depth of approximately 20 metres below ground surface (mbgs). During installation a deeper depth may be desired and the well could extend to 100 mbgs.

.2 Although not responsible for siting the well, the Contractor will be consulted on access to the site for potential equipment restrictions for bridge crossing and narrow road passages.

.3 The Contractor will be expected to follow the specific location requirements with respect to access for proximity to buildings, cleaning, repairing, monitoring and inspecting.

.4 The well must have the adequate distance above ground surface and be equipped with a cap to prevent entry of surface water and foreign materials.

.5 Departmental Representative will provide coordinates for the location of the site.

1.2 REFERENCES

.1 Province of Alberta Water Act (Latest Edition)

.2 Province of Alberta Water Act Ministerial Regulation (Latest Edition)

.3 Canadian Standards Association (CSA)

.4 American Society for Testing and Materials International (ASTM)

1.3 LOCATION

.1 The location of the well(s) will be within the vicinity of Crandell Mountain Campground as follows:

.1 Production Well: Coordinates to be confirmed by the Departmental Representative.

.2 Observation Well: Coordinates to be confirmed by the Departmental Representative.

.2 Refer to drawing SK301 for approximate location of wells.

1.4 MEASUREMENT FOR PAYMENT

.1 Production Wells

.1 Measure for payment for production water supply well installation will be in metres below ground surface (mbgs), in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment shall be made under “Well Drilling to Target Depth – Production Well”.

.2 Observation Wells

.1 Measure for payment for observation water supply well installation will be in metres below ground surface, in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment shall be made under "Well Drilling to Target Depth – Observation Well".

.3 Testing

.1 Measure for payment for water supply well testing will be Lump Sum, in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment shall be made under "Well Testing and Commissioning – Well Testing".

.4 Pump Installation

.1 Measure for payment for supply and installation of the pump will be Lump Sum, in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment shall be made under "Well Testing and Commissioning – Supply and Installation of Pump".

.5 Items considered incidental to the Work include, but are not limited to:

.1 Supply and installation of casing to a depth of 20mbgs but allow for up to 100mbgs, regardless of type and size of casing permanently installed.

.2 Supply and installation of well cap.

.3 Supply and installation of screen, regardless of type and size of screen permanently installed.

.4 Site preparation for level working area, including brushing as required.

.5 Generators, or other temporary sources of power, as required by the work.

.6 Gravel packing.

.7 Grouting and well head protection seal.

.8 Pump appurtenances such as check valve, fittings, drop pipe, pitless adaptor, electrical caballing, pump controller, water-tight junction box, torque arrester, and safety cable.

.9 Disinfection of well.

.10 Well abandonment.

.11 All other pertinent appurtenances required to outfit the groundwater well to a functioning state.

.12 All other costs relating to increasing the well depth to 20 mbgs.

.13 Redrilling of holes lost due to caving or abandoned due to loss of drilling equipment

.14 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.15 Environmental mitigations required in accordance with the National Best Management Practices for Geotechnical Investigations – February 2016 and Decontamination Protocol for Parks Canada Fisheries and Aquatic Technicians – May 2017.

.6 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

.7 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization".**

1.5 GENERAL

.1 The Contractor is expected to supply the appropriate drilling method(s) and well materials to reach the target depth for well completion.

.2 One observation well is required to be drilled and completed in the same zone as the production aquifer for the purpose of aquifer testing.

.1 The specifications of the observation well and distance and orientation from the production well will be specified by the Departmental Representative provided site hydrogeologist.

.3 The Contractor must complete detailed logging of lithology, examine cuttings and perform geophysical logging from which to select the most suitable aquifer unit.

.4 The Contractor may source water from the existing well, as described in Section 01 11 00 – Summary of Work.

.5 There is no power available onsite, the Contractor shall provide generators, or other temporary sources of power, for purposes of completing the work and testing.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 – Submittal Procedures.

.2 Keep records during drilling operations and report details of the well drilled to Alberta Environment and Parks.

.3 On completion of Work, submit a report to the Departmental Representative containing:

.1 Log of well drilling.

.2 Geophysical logs.

.3 Record drawing of well including:

.1 Elevations.

.2 Size and length of each casing section installed.

.3 Grouting details.

.4 Description of screen.

.5 Gravel packing details.

.4 Records of static water level measurements, times at which they were taken and any observable changes in static water level with well depth.

.5 Results of interim and final pumping tests.

.6 Well development data.

.7 Type and size of permanent well pump.

.8 Well maintenance instructions.

1.7 QUALIFICATIONS

.1 The Contractor must possess a “Class A Approval”, in accordance with Alberta Water Act and Water Ministerial Regulation and be able to drill wells intended for the diversion and use of groundwater for any purpose.

.2 The Departmental Representative will provide a hydrogeologist to advise on well construction, materials and perform well water sampling.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.9 PROJECT CONDITIONS

.1 An existing well on the campground is completed at approximately 17 mbgs and was step tested to a maximum production rate of 6455 m3/day. Details of well completion or lithology were not available and the maximum sustainable pumping rate was not assessed as per Alberta Q20 guidelines.

Part 2 Products

2.1 GENERAL

.1 Well materials must be new and meet the minimum requirement used in drilling and construction of water wells as set by the Contract Documents, CSA and ASTM.

2.2 PUMP

.1 Installation of the pump size and depth will be specified after completion of aquifer testing by the site hydrogeologist. Costs for pump installation should be included for a maximum target depth of 100 mbgs but may be extended deeper according to site hydrogeologist. Contractor is to include in their price a pump that meets the following specifications:

.1 230V, 5HP, 1 phase, 60hz, NSF61 approved submersible pump capable of at least 32 gpm and suitable for the potential of sand handling. Discharge head, bowl, sleeve, shaft coupling, bearing spider, shim, cable guard screws, cable guard, motor adaptor, casing, coupling, suction screen, check valve poppet, check valve seat, and check valve retaining ring to be 302/303 / 304 stainless steel. Check valve seal to be FDA compliant BUNA-N. Upper bearing spider, diffuser, impeller to be corrosion resistant and non-toxic glass filled engineering composite. Bearings to be polymer. Well pump shall be Goulds 35GS50 or approved equal.

.2 230V, 5HP, 3.7kW control box with start and run capacitors, Type 3R enclosure, and manual reset overloads. To be for use with 3 wire, single phase motors. Goulds CSCR Deluxe Control Box with SW terminal or approved equal.

.3 230V, 5HP, single phase Pumpsaver with external current transformer and protection from dry well (run dry condition), flow restrictions (dead head), over current (jammed impeller), over voltage, under voltage, and rapid cycling. The controller shall be suitable for this application and include calibration to specific pump / motor combinations and various conditions, run light, calibration light, and sensitivity adjustment for dry well trip point. Goulds 235 Pumpsaver Plus or approved equal.

2.3 PERMANENT WELL CASING

.1 Permanent well casing to be NPS 6" SCH40S ASTM A53 GRB steel pipe.

.2 Drop pipe to be NPS 50Ø ASTM A312 TP304 SCH40S .

.3 Discharge pipe from the reducer to pitless adaptor to be NPS 50Ø ASTM A312 TP304 SCH40S and include C/W cable guards for safety cable, power cable, and torque arrestor.

.4 Check valve to be 50Ø NPT Brass Poppet Check Valve, Maass Midwest No. 530 or equal.

.5 Reducer to be 50x38Ø NPT ASTM A182 F304.

.6 Discharge pipe form the well pump to reducer to be 38Ø NPT ASTM A312 TP304 SCH40S

.7 Joints: threaded couplings.

.8 Pitless adaptor shall be a weld-on type, using an eight degree bronze locking type wedge with an O-ring forced against a non-magnetic type 304 stainless steel flanged nipple. The housing of the adapter will be of cast steel with 50mm (2") drop pipe connection Maass Midwest Model J Weld-On Pitless Adaptor or approved equal.

2.4 SCREEN

.1 Based on the desired flow rate, the Contractor will determine the well screen diameter, screen length, slot size filter pack (if required) to ensure good well performance and that the target flow objective is achieved.

.2 Screen to be in accordance with CSA and ASTM standards, and as approved by the Departmental Representative.

Part 3 Execution

3.1 DRILLING

.1 Use drilling equipment, methods, fluids and additives approved by Departmental Representative.

.2 Drill in locations and to depths and diameters as indicated and as directed by Departmental Representative.

.3 Drill holes plumb and straight.

.4 Dispose of drill cuttings as directed by Departmental Representative.

.5 Ensure drilling methods do not impair production from aquifers encountered.

.6 Prevent foreign matter from entering bore hole and prevent contaminated water or other objectionable fluids from reaching aquifer through bore hole.

.7 Cover top of bore hole to prevent tampering and eliminate dangerous conditions for persons or animals in area.

.8 Maintain log of bore holes including following information:

.1 Depth of changes in formation.

.2 Description of formations encountered.

.3 Elevations at which aquifers are encountered, sudden changes in water level, loss of drilling fluid or other indications of permeable strata.

.4 Electric logging test results.

.9 In unconsolidated formations, obtain duplicate soil samples from each 3 m of depth drilled and at least one set of duplicate samples from each formation encountered. Submit samples to Departmental Representative with identification data on drill hole and depth.

.10 Obtain continuous samples for at least 7 m through aquifer to be screened using split spoon sampling or other method approved by Departmental Representative.

.11 In consolidated formation, obtain one rock sample from each 6 m of depth drilled.

.12 Conduct well development and pumping tests and obtain clear water samples as directed by Departmental Representative.

.13 Be prepared to control, shut off and seal hole should flowing artesian water or gas be encountered.

.14 Seal abandoned holes by approved methods with concrete, cement bentonite grout, or other material approved by Departmental Representative.

.15 Redrill holes lost due to caving or abandoned due to loss of drilling equipment.

3.2 SCREEN INSTALLATION

.1 When aquifer material has been sampled and analyzed, Departmental Representative to be advised on type and size of screen required.

.2 Install screen to manufacturer's recommendations.

3.3 PERMANENT WELL INSTALLATION

.1 Clean casing pipe and fittings prior to installation.

.2 Install permanent well casing to sizes and depths as indicated and as directed by Departmental Representative.

.3 Protect pipe casing against damage.

.4 Centre casing by use of centreing brackets spaced maximum 15 m apart and install so that variance from vertical does not exceed two thirds internal diameter of casing per 30 m of depth.

.5 Prove alignment by lowering straight section of pipe 12 m long, with outside diameter maximum 12 mm smaller than internal diameter of casing being tested, into casing. If plumb fails to move freely through casing to lowest anticipated pumping level, correct alignment.

.6 Seal annular space between casing and borehole wall by grouting, to prevent entrance of surface water or other deleterious matter into aquifer, and to prevent intermixing of water.

.7 After grouting is completed, cut off casing squarely and neatly, maximum 450 mm above ground level and minimum 600 mm above highest recorded flood level. Cover casing with cap to approval of Departmental Representative.

.8 Maintain accurate records of casing lengths and sizes installed.

3.4 GRAVEL PACKING

.1 Gravel used for gravel packing to be clean, rounded, water washed quartz or granitic gravel free of silt, clay and other deleterious materials.

  .1 Gradation to be specified by Departmental Representative after analysis of aquifer samples.

  .2 Relative density (formally specific gravity): minimum 2.5.

  .3 Thin, flat and elongated particles: maximum 2% by mass.

.2 Place gravel packing as indicated by approved methods acceptable to Departmental Representative.

.3 Store gravel packing in manner which avoids contamination.

3.5 GROUTING AND SEALING

.1 Seal casing of well extending into consolidated formation into upper 1.5 m of formation by grouting with neat cement grout.

.2 Drive steel casing into consolidated formation until seal is obtained. Grout thermoplastic casing into upper 1 m of formation.

.3 Fill annular space below 3 m depth as indicated.

.4 Grout annular space from ground surface to 3 m depth using neat cement grout.

.1 Neat cement grout to be mixture of Type 10 Portland cement with maximum 8% by mass bentonite clay and 2% calcium chloride added and water in ratio of 19 L of water per 42.6 kg bag of cement.

.5 Place grout from bottom up by methods approved by the Departmental Representative. Place grout in one continuous operation with entire amount placed before initial set occurs.

.6 Use retainer, packer or plug at bottom as necessary to ensure grout does not leak into well.

.7 When further drilling is required after grouting, do not drill until 72 hours after complete placement of grout.

3.6 DISINFECTION

.1 Following installation of the water well, the drilling contractor is responsible for developing and disinfecting the well and completing a yield test as specified under the Water Ministerial Regulation.

.2 After well has been completely constructed, thoroughly clean of foreign substances, including tools, timbers, rope, cement, oil, grease, joint dope and scum. Thoroughly swab casing pipe using alkalis if necessary to remove oil, grease or joint dope.

.3 Disinfect well in accordance with AWWA C654, latest edition.

3.7 TEST PUMPING

.1 Equipment requirements:

.1 Supply all the equipment, including but not limited to: pump and drop pipe, power plant and fuel, min. 100 m of discharge hose, flow regulator to maintain desired flow rates.

.2 The pump for the step-rate test should be sized to provide up to 400 imperial gallons per minute.

.3 Pump with variable pumping rate up to capacity of at least 400 imperial gallons per minute and capable of operating a minimum of 24 h without interruption.

.4 Discharge piping of sufficient size and length to conduct water being pumped during test to approved point of discharge where it will not recharge aquifer, damage property or create nuisance and equipped with valve close to pump.

.5 Apparatus to measure rate of pump discharge to be orifice plate with transparent tube to measure water head upstream of plate, or suitable water metre.

.6 Apparatus to measure pumping level to be electric sounder.

.2 Conduct interim test pumping during construction as directed by the Departmental Representative.

.3 Develop well, if necessary, to reduce concentration of suspended solids to maximum 5 mg / L.

.4 A step-rate well performance testing and a constant-rate aquifer test are required as part of the program.

.1 The step-rate well test is expected to have 4-6 steps at one-hour intervals.

.2 The constant-rate test will run 24 hours and at least 90% recovery to the non pumping water level.

.5 The aquifer will be allowed to recover between the step-rate and constant-rate test.

.6 Final test pumping as follows:

.1 After pumping begins, record water level in well at following intervals: every minute for first 10 min, every 2 min for next 10 min, every 5 min for next 40 min, every 10 min for next 1 h, every 30 min for next 3 h every hour for next 5 h and every 2 h to end of test.

.7 When test pumping is to be conducted after disinfection, swab with strong chlorine solution parts of test pump coming into contact with well water prior to start of test pumping.

.8 Should test pump fail during pump test, allow water to reach static level prior to recommencing test. No payment will be made for pump time prior to such failure.

.9 Do not allow pumping level to fall below elevation 2 m above top of well screen.

3.8 WATER SAMPLING

.1 To be conducted by the Departmental Representative.

END OF SECTION

33 31 11 PUBLIC SANITARY SEWERAGE GRAVITY PIPING

Part 1 General

1.1 DESCRIPTION

.1 Supply and install gravity sewer mains as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCE STANDARDS

.1 City of Calgary Standard Specifications for Sewer Construction, latest edition.

.2 ASTM International (ASTM)

.1 ASTM C117-[04] , Standard Test Method for Material Finer Than 75 [MU] m (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-[06] , Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM C443M-[07] , Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).

.4 ASTM D698-[07e1] , Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft4-lbr/ft^3(600 kN-m / m^3)).

.5 ASTM D2680-[01(2009)] , Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

.6 ASTM D3034-[08] , Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.7 ASTM D3350-[10] , Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-[M88] , Sieves, Testing, Woven Wire, Metric.

.4 CSA Group (CSA)

.1 CSA A3000-[08] , Cementitious Materials Compendium.

.2 CSA A257 Series-[09] , Standards for Concrete Pipe and Manhole Sections.

.3 CSA B1800-[11] , Thermoplastic Non-pressure Pipe Compendium.

.1 CSA B182.1-[11] , Plastic Drain and Sewer Pipe and Pipe Fittings.

.2 CSA B182.2-[11] , PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.

.3 CSA B182.6-[11] , Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications.

.4 CSA B182.11-[11] , Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Supply and installation of Sanitary Gravity Mains:

.1 Measure for payment of sanitary sewer in open trench will be linear metre measured along the surface above the pipe, measured between manholes, supplied

and installed in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under **"Sanitary Gravity Mains (150mm PVC SDR35)"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.2 Items considered incidental to the Work include, but are not limited to:

.1 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.2 All survey, excavating, trenching, backfill and bedding.

.3 Pipe laying, storage, jointing, bends and appurtenances and testing of system including costs associated with camera testing.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by Professional Engineer registered or licensed in Alberta, Canada for the manholes and all underground septic tanks.

.2 Indicate on drawings proposed manhole and tank dimensions, inlet, outlet and rim elevations or review and approval.

.4 Samples:

.1 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.2 Submit for testing at least 2 weeks prior to beginning Work, samples of materials proposed for use as follows:

.1 Sieve analysis to be provided for pipe zone bedding material being used.

.5 Certificates:

.1 Certification to be marked on pipe.

.6 Test and Evaluation Reports:

.1 Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.7 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to CSA B182.2

.1 Standard Dimensional Ratio (SDR): 35.

.2 Separate gasket and integral bell system.

.3 Nominal lengths: 6 m.

.4 All joints to meet requirements of specification for joints for drain and sewer plastic pipes using flexible elastomeric seals ASTM 03212.

.5 May be any colour except blue.

.6 PVC pipe to be in accordance with City of Calgary sewer construction standards.

2.2 SERVICE CONNECTIONS

.1 Type PSM Poly (Vinyl) Chloride: to CSA B182.2.

.2 Plastic pipe: to CSA B182.1, with push-on joints.

2.3 CEMENT MORTAR

.1 Portland cement: Mortar, if specifically required and approved for pipe joints, shall consist of one part sulphate resistant cement Type HS (Type 50) in accordance with CSA A3001 or Type V in accordance with ASTM C150 to two parts of clear sharp sand.

.2 Cement mortar to be as per City of Calgary Standard Construction Specifications.

2.4 PIPE BEDDING AND SURROUND MATERIALS

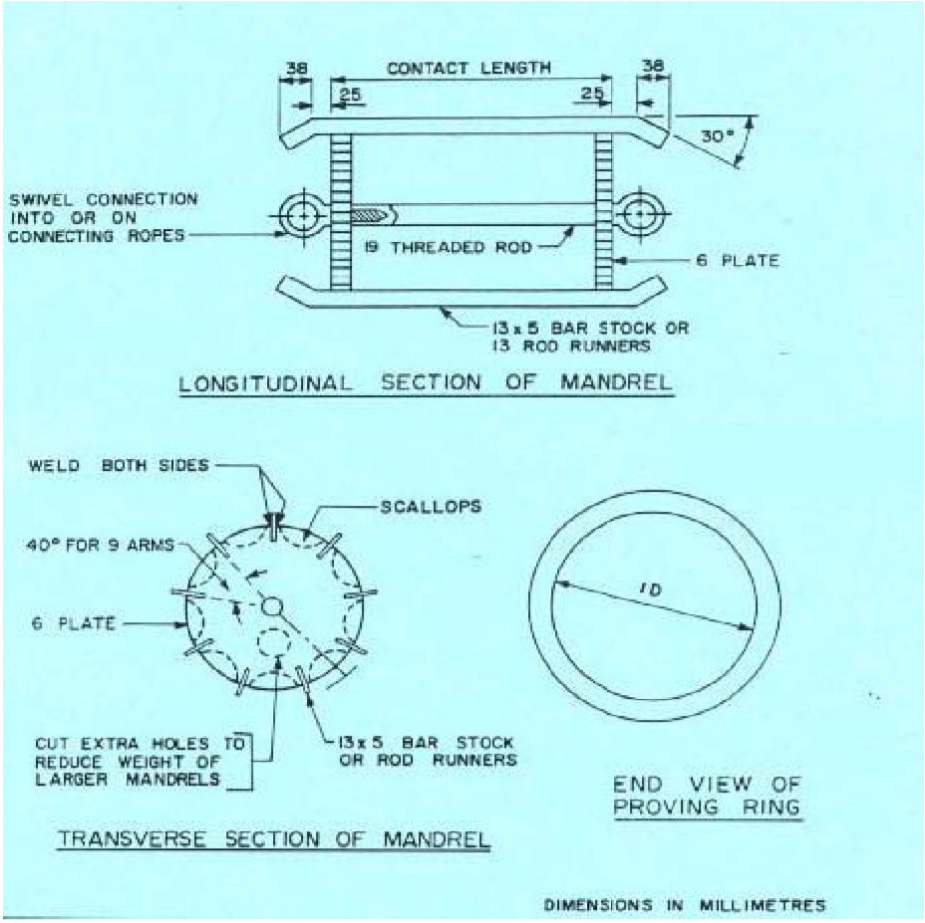
.1 As per Section 31 23 33.01 Excavating, Trenching and Backfilling.

2.5 BACKFILL MATERIAL

.1 As per Section 31 23 33.01 Excavating, Trenching and Backfilling.

2.6 MANDREL

.1 The mandrel shall be cylindrical in shape, constructed with nine evenly spaced arms and shall conform to the following schematic:



.2 The minimum diameter of the circle scribed around the outside of the mandrel arms shall be equal to the values indicated below for each specific pipe material, within a tolerance of +/- 0.025mm. The contact length of the mandrel arms shall be checked for conformance with proving rings.

.3 Either an oversize or undersize proving ring shall be used to confirm the acceptability of mandrel dimensions. An oversize proving ring shall be of a diameter equal to the required Outside of mandrel size plus 1mm. An undersized proving ring shall be of a diameter equal to the mandrel size minus 0.30 mm.

.4 Both proving rings shall be manufactured to within 0.25 mm of specified size. The proving rings shall be fabricated from 6mm minimum thickness stainless steel.

.5 An acceptable mandrel will pass through the oversize ring but not through the undersize ring.

.6 The allowed vertical deflection shall be as follows: .1 For testing done after 30 days, short term deflection, maximum allowable deflection is 5%. .2 For testing done after one-year, long term deflection, maximum allowable deflection is 7.5%.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sewer pipe installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Clean pipes and fittings of debris and water before installation and remove defective materials from site to approval of Departmental Representative.

.2 Clean and dry pipes and fittings before installation.

.3 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

3.3 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling

.2 Protect trench from contents of sewer or sewer connection.

.3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

.1 Granular bedding to be in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling

3.5 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 directed by the Departmental Representative.

.2 Position pipe on concrete blocks to facilitate placing of concrete.

.1 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.

3.6 INSTALLATION

.1 Lay and join pipe in accordance with manufacturer’s recommendations.

.2 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection or maximum bending radius recommended by pipe manufacturer.

.6 Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.

.7 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.

.9 Pipe joining:

.1 Install gaskets as recommended by manufacturer.

.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 carefully 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. Remove disturbed or dirty gaskets; clean, lubricate and replace 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 manufacturers recommendations.

.10 Block pipes as directed when any work stoppage occurs, to prevent creep during down time.

.11 Plug lifting holes with approved prefabricated plugs set in non-shrink grout.

.12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner as recommended by pipe manufacturer without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes. Use non shrink grout when suitable gaskets are not available.

.14 Use prefabricated saddles, tees or approved field connections for connecting pipes to existing sewer pipes. Joint of saddle to pipe shall be structurally sound and watertight.

.15 Upon completion of pipe laying and after Departmental Representative has inspected pipe joints, place specified granular material to dimensions indicated or directed and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.16 Backfill remainder of trench in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.7 WASHROOM SERVICE CONNECTIONS

.1 Install pipe to CSA B182.1 and manufacturer's standard instructions and specifications.

.2 Use prefabricated wye branches or tees approved by Engineer for service connections to main sewer and install during construction of sewer main. Do not use break in and mortar patch type joints.

.3 Service connection pipe shall not extend into interior of main sewer.

.4 Make up required horizontal and vertical bends form 45º bends or less, separated by a straight section of pipe with a minimum length of four pipe diameters. Use long sweep bends where applicable.

.5 Pipe shall be laid straight and true at a minimum grade of 2% for 100mm and 1% for 150 mm. No horizontal bends will be allowed unless approved by Engineer.

3.8 FIELD TESTING

.1 Carry out tests on each section of sewer between successive manholes including service connections.

.2 Camera Testing

.1 All sewers shall be inspected by camera after backfilling of the trench to finished grade.

.2 The inspection shall be made by employing television scanning equipment which shall be provided by the Contractor or its agent acceptable to the Departmental Representative to carry out the inspection.

.3 All television inspection shall be carried out in the presence of the Departmental Representative who shall be given at least 48 hours notice of any testing to be carried out. Television inspection shall be performed by the Contractor on all sewers unless otherwise directed by the Departmental Representative.

.4 The closed-circuit television Contractor shall provide all equipment and materials necessary to conduct the inspection as specified herein.

.5 The television equipment shall be a self-contained camera and monitoring unit connected by cable. It must be waterproof and be capable of lighting the entire pipe. Picture capabilities must be of quality to show the entire pipe periphery. There must be capability of providing measurement within the line to an accuracy of one third of a meter per kilometer. Picture quality must be such to produce a continuous 600 line resolution picture showing the entire periphery of the pipe.

.6 The following capabilities and items must be available.

.1 A direct voice communication.

.2 A camera towing service.

.3 Self-contained electrical power.

.4 Proper safety equipment to protect employees and the general public.

.7 The cameras rate of progress shall be uniform during inspection and shall not exceed 6 m / min

.1 A television log shall be maintained during the inspection showing location of leak, fault open joint, break, crack collapse settlement, obstruction, infiltration, or any other defect affecting the overall

performance of the sewer line. The location of the defect shall be referenced from the manhole.

.2 A separate log shall be kept of service connections with comments of condition.

.3 Photographs shall be taken as directed by the Departmental Representative or at the discretion of the television scanning operator. A minimum of one photo per manhole reach is required plus one of every deficiency.

.4 Manhole identity shall be noted clearly as indicated on the drawings.

.8 A final typewritten report with corresponding photographs secured properly and referenced to the text along with a copy of the video tape shall be submitted within two (2) weeks of the completion of the inspection.

.9 The Contractor shall be responsible for all works performed by the subcontractor, for traffic control and any other related work incidental to the completion of television inspection.

.10 Construction completion certificate for sanitary mains will not be issued until the camera inspection report is complete and approved by the Departmental Representative.

.3 Alignment and Grade

.1 Sewer main will be checked for alignment during construction. Any deviation from design alignment greater than 50 mm shall be corrected prior to backfilling.

.2 Sewer main design grade to be maintained as direct by Departmental Representative. Any apparent discrepancies are to be reported immediately. Grade to be continuous through manhole. Invert elevation shall be within 50 mm of design elevation at manholes

.4 Visual Inspection

.1 Sewer mains shall be tested by means of a light test. For satisfactory alignment, illuminated interior of pipe shall not show any substantial misalignments or pipes or gaskets or other defects. On large diameter pipes where light test not effective, pipe interior shall be inspected by walking through pipe.

.2 Any defect located shall be repaired at the Contractor's expense as directed by the Departmental Representative.

.5 Deflection Testing

.1 Should visual or camera testing reveal any questionable areas with respect to pipe sag, the section of the pipe in question shall be tested by means of a go / no-go mandrel device which will confirm that the vertical deflection does not exceed the allowable deflection limit stipulated below.

.2 If deflection testing is deemed necessary by the results of visual or camera testing, the mandrel device shall be supplied by the contractor at no cost to the owner.

.3 All deflection tests shall be conducted not sooner that 30 days after all backfill has been completed.

.4 Short term deflection shall be deemed to be any deflection measured not sooner than 30 days after backfilling and must be completed prior to the issuance of the CCC (Construction Completion Certificate).

.5 Long term deflection shall be deemed to be any deflection measured after one year of backfilling and prior to FAC acceptance

.6 The allowed vertical deflection shall be as follows: .

.1 For testing done after 30 days, short term deflection, maximum allowable deflection is 5%.

.7 For testing done after one-year, long term deflection, maximum allowable deflection is 7.5%

.6 Repair and retest sewer line as required, until test results are within limits specified.

.7 Repair visible leaks regardless of test results.

3.9 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding [150] mm compacted thickness as indicated.

.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% Standard Proctor Maximum Dry Density to ASTM D698.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 95% Standard Proctor Maximum Dry Density to ASTM D698.

.7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.10 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95 % Standard Proctor Maximum Dry Density to ASTM D698.

.1 In other areas, compact to at least 90 % Standard Proctor Maximum Dry Density to ASTM D698.

.4 Place unshrinkable fill in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

END OF SECTION

33 31 23 SANITARY SEWERAGE FORCE MAIN PIPING

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of sanitary force main piping as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute / American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C104 / A21.4-[08] , Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

.2 ANSI/AWWA C111 / A21.11-[06] , Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.3 ANSI/AWWA C151 / A21.51-[09] , Standard for Ductile-Iron Pipe, Centrifugally Cast.

.4 ANSI/AWWA C207-[07] , Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 Inch Through 144 Inch (100 mm Through 3,600 mm).

.5 ANSI/AWWA C600-[10] , Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

.6 ANSI/AWWA C900-[07] , Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inch Through-12 Inch (100 mm-300 mm), for Water Transmission and Distribution.

.2 ASTM International (ASTM)

.1 ASTM C136-[06] , Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM C117-[04] , Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM D698-[07e1] , Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbr/ft^3) (600kN-m / m^3)).

.4 ASTM D2241-[09] , Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

.5 ASTM D2310-[06] , Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

.6 ASTM D2992-[06] , Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.

.7 ASTM D2996-[01(07)e1] , Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber- Reinforced Thermosetting Resin Pipe).

.8 ASTM D3034-[08] , Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.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-34.1-[M94] , Asbestos-Cement Pressure Pipe.

.4 CGSB 41-GP-25M-[77] , Pipe, Polyethylene, for the Transport of Liquids.

.4 CSA Group (CSA)

.1 CAN/CSA-B70-[06] , Cast Iron Soil Pipe, Fittings, and Means of Joining.

.2 CSA B137 Series-[09] , Thermoplastic Pressure Piping Compendium.

.5 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832 / R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measure for payment of Sanitary Sewer Force Mains in open trench will be linear metre measured along the surface above the pipe, measured between manholes, supplied and installed in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under **"Sanitary Force Mains (50mm HDPE DR11)"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Items considered incidental to the Work include, but are not limited to:

.1 Hydrovac and confirmation of existing washroom and kiosk building sanitary service connection alignments and inverts into the buildings.

.2 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.3 All survey, excavating, trenching, backfill and bedding.

.4 Removal of existing force main, pipe laying, tracer wire, bends and all appurtenances, jointing, thrust blocking, temporary connections, testing and flushing.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions [and adhere to schedule approved by Departmental Representative.

.3 Notify Departmental Representative and building [manager] [superintendent] a minimum of 24 hours in advance of interruption in service.

1.6 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by Professional Engineer registered or licensed in Alberta, Canada.

.2 Submit shop drawings showing proposed method of installation for sewage force main in undercrossing.

.4 Samples:

.1 Submit 2 weeks minimum before beginning Work, with proposed source of bedding materials and provide access for sampling.

.5 Certification to be marked on pipe.

.6 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.

.7 Manufacturer's Instructions: submit to Departmental Representative 1 copy of manufacturer's installation instructions.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 High Density Polyethylene Pipe (HDPE) 50mm in diameter use DR 11 with a pressure class of 200 PSI (or approved equivalent). HDPE pipe will conform to AWWA C901-17 standard and shall be PE 4710.

.2 High Density Polyethylene Pipe joints, bends, tees will be fused as per manufacturers specifications by certified personnel.

2.2 TRACER WIRE

.1 Tracer wire shall be 10 AWG conductor, solid white, TWU flame seal wire, with Burndy KS-90, 16-10 connectors.

2.3 PIPE BEDDING AND SURROUND MATERIALS

.1 As per Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.4 BACKFILL MATERIAL

.1 As per Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Mark and remove defective materials from site.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

.2 Trench alignment and depth as established by Departmental Representative.

.3 Do not back fill trenches until installed work has been inspected by the Departmental Representative.

3.4 GRANULAR BEDDING

.1 In accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

3.5 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations.

.2 Field joining of HDPE pipe will be completed in accordance with ASTM F2620 and manufacturers recommendations.

.3 Tracer wire shall be laid immediately alongside and at the bottom of the new force main. Wire shall be continuous up to both ends of the force main and shall be rolled into a coil immediately below the access lids.

3.6 THRUST BLOCKS

.1 Provide thrust blocks at both exterior of lift station and downstream manhole.

3.7 PIPE SURROUND

.1 In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.8 BACKFILL

.1 In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.9 FIELD TESTING OF FORCE MAIN

.1 Testing of force main to be carried out in presence of Departmental Representative.

.2 Provide labor, equipment and materials required to perform hydrostatic and leakage tests hereinafter described. This may include but not limited to connections, fittings, generators and potable water supplied by the contractor.

.3 Notify Departmental Representative at least 24 hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.

.4 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five (5) days after placing concrete or two days if high early strength concrete is used.

.5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Departmental Representative.

.6 Test pipeline including service connections after all backfilling is complete.

.7 Open valves within test section and test section in accordance to the City of Calgary's Standard for Testing and Disinfecting Water Mains.

.8 Expel air from main by slowly filling main with potable water. Install corporation stops where required to expel air at high points, or to flush dead ends in main, as directed by Departmental Representative. Close stops after satisfactory completion of test. Air pressure testing of installed PVC pressure pipe is expressly prohibited for safety reasons.

.9 Apply hydrostatic test pressure of 1035 kPa for a period of two (2) hours.

.10 Relieve hydrostatic pressure on each section of pipeline segment at the end of the test period.

.11 Define leakage as amount of water supplied in order to maintain test pressure for two (2) hours.

.12 Do not exceed allowable leakage as defined in AWWA C600-82.

.13 Locate and repair defect is leakage is greater than amount specified.

.14 Repeat test until leakage is within specified allowance for full length of water main.

.15 When testing is done during freezing weather, protect valves, joints and fittings from freezing.

.16 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.17 Upon successful commissioning and test reporting of any works completed under this contract the contractor will assist PCA with winterization of the force mains including the full drainage of the force mains once testing is completed and accepted.

END OF SECTION

33 36 00 WASTEWATER UTILITY STORAGE TANKS

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of septic holding tanks at washroom buildings and RV Dump Station as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

.1 Commissioning testing equipment may include but is not limited too the supply of generators for power, connections, pumps and potable water supply for system testing will be required and incidental to the unit costs in this section.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C117-[13] , Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136 / C136M-[14] , Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698-[12e2] , Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbr/ftμ (600 kN-m / mμ)).

.4 ASTM D1248-[12] , Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

.5 ASTM D2583-[13a] , Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

.2 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 CSA Group

.1 CSA A23.1-14 / A23.[2-14] , Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.

.2 CSA A23.4-[16] , Precast Concrete - Materials and Construction.

.3 CSA B66-10[(R2015)] , Design, Material and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks.

.4 CAN/CSA-B1800-[15] , Thermoplastic Non-Pressure Piping Compendium (formerly CAN/CSA-B182.4-2002 and CAN/CSA-B182.6-2011).

.4 Safety Codes Council

.1 Alberta Private Sewage Systems Standard of Practice 2015

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Supply and installation of Partitioned Septic Treatment Tank:

.1 Measure for payment of Partitioned Septic Treatment Tank will be based on each unit supplied and installed in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under the applicable item below and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.1 "Partitioned Septic Treatment Tank Loop A (15,000 L)"

.2 "Partitioned Septic Treatment Tank Loop B (15,000 L)"

.3 "Partitioned Septic Treatment Tank Loop D (20,000 L)"

.4 "Partitioned Septic Treatment Tank Loop E (15,000 L)"

.2 Supply and installation of Septic Treatment Dosing Tank:

.1 Measure for payment of Partitioned Septic Treatment Tank will be based on each unit supplied and installed in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under the applicable item below and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.1 "Septic Treatment Dosing Tank – Loop A (5,000 L)"

.2 "Septic Treatment Dosing Tank – Loop B (5,000 L)"

.3 "Septic Treatment Dosing Tank – Loop D, & E (10,000 L)"

.3 Septic Alarm System:

.1 Measure for payment of Septic Alarm System will be Lump Sum for the complete system supplied and installed in accordance with the Contract Documents or as directed by the Departmental Representative.

.2 Payment shall be made under "**Septic Alarm System**" and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.4 Items considered incidental to the Work include, but are not limited to:

.1 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.2 All survey, excavating, trenching, backfill and bedding.

.3 Partitioned Septic Treatment Tank:

.1 All pumps, discharge piping, fittings, controls and wiring necessary to connect to the sanitary forcemain as per the Contract Documents.

.2 Connection of the building sewer from the washroom.

.3 All manways and lids required.

.4 Septic Treatment Dosing Tank:

.1 All pumps, discharge piping, fittings and controls necessary to connect to the effluent discharge lines as per the Contract Documents

.2 Zone distribution valve, all pipe and fittings required to connect to pump discharge piping, pit, lid, drainback to tank and all pipe and fittings required to connect to lines feeding treatment field zones.

.3 All pipe and fittings required to make connection from the sanitary effluent forcemain to the tank.

.4 All manways and lids required.

.5 Septic Alarm System

.1 All cabinets, and junction boxes as per the design documents required for a complete and operational system as per Section 26 05 31 – Splitters, Junction Boxes and Cabinets.

.2 All control devices as per the design documents required for a complete and operational system as per Section 26 29 03 – Control Devices.

.3 All electrical conduits for connection between kiosk and washroom buildings as per the design document to be in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and Ducts.

.5 Traffic Control required for this Work shall be incidental to "**Traffic Accommodation**" and no separate payment will be made to the Contractor.

.6 Mobilization and demobilization required for this Work shall be incidental to "**Mobilization / Demobilization**" and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

.2 Manufacturers of precast concrete elements are to be certified by CSA as meeting requirements of CSA A23.4.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for utility septic tanks and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by Professional Engineer registered or licensed in Alberta, Canada.

.2 Shop Drawings: to CSA A23.4. Indicate on drawings:

.1 Design calculations for items designed by manufacturer.

.3 Tables and bending diagrams of reinforcing steel.

.4 Camber.

.5 Formwork.

.6 Finishing schedules.

.7 Methods of handling and erection.

.8 Storage facilities.

.9 Openings, sleeves, inserts and related.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect septic tanks from nicks, scratches, and blemishes

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Design fibreglass reinforced polyester septic tanks in accordance with CSA B66, and to carry handling stresses and indicated service loads.

.2 Tank to have minimum total working capacity as noted on the design drawings.

2.2 FIBREGLASS REINFORCED POLYESTER TANKS

.1 Thermosetting resin system reinforced with glass fibres.

.2 Laminate: combined thickness of interior chemical resistant layer and anti-wicking layer: minimum:

.1 Interior chemical resistant layer: 0.13 to 0.30 mm thick.

.2 Interior anti-wicking layer:

.3 Structural layer:

.4 Exterior layer: resin rich flood coat, no chopped glass, 0.13 to 0.30 mm thick.

.3 Resins, reinforcement and additives to CSA B66.

.4 tank anchoring

.5 Anchor straps shall be as supplied by the tank manufacturer and shall be designed for a maximum load of 11 kN (25,000 lbf).

.6 Galvanized turnbuckles shall be as supplied by the manufacturer.

.7 Prefabricated concrete anchors shall be supplied by the tank manufacturer, designed to the ACI 318 standard, manufactured with 30 Mpa concrete and shall have adjustable anchor points.

2.3 CONCRETE MIXES AND MATERIALS

.1 Concrete mixes and materials: to CSA B66.

.2 Use type GU cement.

2.4 MANUFACTURE

.1 Manufacture units in accordance to CSA A23.4.

2.5 FINISHES

.1 Finish precast concrete tanks to CSA A23.4, commercial grade.

2.6 DOSING CHAMBER

.1 Construct dosing chamber to meet design requirements for septic tanks.

.2 Dosing chamber capacity for each tank shall be as noted on the design drawings.

2.7 ACCESS

.1 Include access holes to surface to facilitate cleaning and inspection.

.2 effluent pumps

.3 Pumps shall be Little Giant® submersible effluent pumps manufactured by Franklin Electric Co. of Fort Wayne, Indiana, USA.

.4 Pump sizes shall be as noted on design drawings.

2.8 CONTROLS

.1 Control for duplex pumps at septic tank shall be SJE / Rhombus Model 122 duplex control panel complete with necessary float switches.

.2 Control for duplex pumps at dosing tank shall be SJE / Rhombus IFS Model IFI-3-1-W-2-4-4-H complete with necessary float switches.

2.9 TANK BEDDING AND SURROUND MATERIAL

.1 Granular material in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfill and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations and bedding / surround material to meet manufacturers requirements.

2.10 BACKFILL MATERIAL

.1 To be native material unless otherwise required by the tank manufacturer for bedding or tank surround material.

.2 Type 3, in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for utility septic tank installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Place bedding and surround material in unfrozen condition.

.2 Do excavation in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Place tank bedding material in accordance with details as indicated.

.1 Compact to 95% Standard Proctor Maximum Dry Density to ASTM D698.

.4 Make inlet and outlet joints of septic tank watertight.

.5 Conduct leakage test on septic tank in presence of Departmental Representative, before backfilling.

.1 Fill tank to level of effluent pipe and allow to stand for 24 hours.

.1 Contractor to provide any connections, generators, and supply of potable water in order to undertake the testing and commissioning.

.2 Allowable leakage is zero.

.3 If leakage occurs, remove seal materials and reseal as directed by Departmental Representative.

.6 Do backfilling in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.1 Compact to 90% Standard Proctor Maximum Dry Density to ASTM D698 or as recommended by the tank manufacturer, whichever is higher.

.7 Test the dosing pumps and alarms to show the wastewater system is fully energized and in working order.

.8 Upon successful commissioning and test reporting of any works completed under this contract the contractor will assist PCA with winterization including the full drainage of the waste water storage tanks after all testing has been completed and accepted.

END OF SECTION

33 36 33 UTILITY DRAINAGE FIELD

Part 1 General

1.1 DESCRIPTIONS

.1 Supply and installation of sanitary septic fields as required to complete the Work as specified in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 ASTM International

.1 ASTM C117-[04] , Standard Test Method for Material Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-[06] , Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-[63(2007)] , Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D4318-[10] , Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 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 CSA Group (CSA)

.1 CAN/CSA-B137 Series-[09] , Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.1 CAN/CSA-B137.1-[09] , Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.2 CAN/CSA-B1800-[11] , Thermoplastic Non-Pressure Piping Compendium. (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 CAN/CSA-B182.2-[11] , PVC Sewer Pipe and Fittings (PSM Type).

.4 Safety Codes Council

.1 Alberta Private Sewage Systems Standard of Practice 2015

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Supply and installation of Septic Treatment Field:

.1 Measure for payment of Septic Treatment Field will be based on the unit completed in accordance with the Contract Document or as directed by the Departmental Representati

.2 Payment shall be made under the applicable item below and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 "Septic Treatment Field – Loop A"

.4 "Septic Treatment Field – Loop B"

.5 "Septic Treatment Field – Loop D, & E"

.2 Supply and installation of Septic Field Distribution Pump:

.1 Septic Field Distribution Pump will be considered incidental to the works and in accordance with the Contract Document or as directed by the Departmental Representative.

.3 Items considered incidental to the Work include, but are not limited to:

.1 Supply, installation and testing of pumps.

.2 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.3 All distribution piping required for the effluent supply from the dosing tank and all septic field laterals, chambers and components as shown on the design drawings.

.4 All survey, excavating, trenching, backfill and bedding

.4 Traffic Control required for this Work shall be incidental to **"Traffic Accommodation"** and no separate payment will be made to the Contractor.

.5 Mobilization and demobilization required for this Work shall be incidental to **"Mobilization / Demobilization"** and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

.2 Use certified and licensed installers who comply with local authority having jurisdiction.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for drainage field materials and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit 20 kg sample of each granular materials 2 weeks minimum before beginning Work.

.4 Certificates:

.1 Submit copy of certification or licence of approved installers.

.5 Test Reports:

.1 Submit 2 certified copies of factory tests of pipe material.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 - Environmental Procedures.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect drainage field materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GRANULAR MATERIALS

.1 Granular material in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfill and to requirements as follows:

.1 As noted in the Alberta Private Sewage Systems Standard of Practice 2015.

2.2 IMPERVIOUS MATERIAL

.1 Material Plasticity Index not less than 15% as measured to ASTM D4318.

.2 Material to have minimum of 50% of particles finer than 0.075mm as measured to ASTM D422.

2.3 CHAMBER SYSTEM

.1 Infiltrator Quick4® Plus Equalizer 36 Low Profile plastic chambers, transitions, and end caps or similar system acceptable to the Departmental Representative.

2.4 PIPE FOR PRESSURE DISTRIBUTED TREATMENT FIELD LATERALS

.1 Straight PVC pipe and fittings to CAN/CSA-B182.2, unperforated. Orifices to be field drilled as noted on the design drawings

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for drainage field installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 CHAMBER SYSTEM TREATMENT FIELD INSTALLATION

.1 Excavate to lines and depths as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling. As installed in field, trench grades shall be nominally level along their length.

.2 Scarify trench base and walls under dry conditions.

.3 Operate construction equipment across disposal only after receipt of written approval from Departmental Representative.

.4 Install headers for each treatment field zone as shown on the field drawings. Installation to be water-tight construction.

.5 Set headers level as indicated.

.1 Provide access with removable cover for valves and cleanouts as noted on design drawings.

.6 Measure and drill orifices in pressure distribution lateral pipes at locations, spacing and orientation shown on design drawings.

.7 Place and assemble pressure distribution laterals at level noted on appropriate pipe stands in trench as shown on design drawings.

.8 Connect each distribution pipe individually to header.

.9 Install cleanouts on free ends of pressure distribution lateral pipes as shown on design drawings.

.10 Maintain pipe elevations at 100mm above trench bottom as shown on the design drawings.

.11 Open cleanouts and purge all laterals with water to remove debris. Ensure all orifices are clear.

.12 Conduct pressure (squirt) test and adjust header valves to ensure head (squirt height) is 1.5 m ±10% throughout each zone.

.13 Contractor is responsible for providing and connections, generators and potable water supply in order to undertake any testing and commissioning of the fields.

.14 Install chambers over laterals as per manufacturer's guidelines and as shown in the design drawings.

.15 Install monitoring ports in chambers at locations specified.

.16 Do not backfill trenches until installation has been approved by Departmental Representative.

.17 Backfill trenching with material as indicated.

.1 Use only material approved in writing by Departmental Representative to backfill.

.2 Do not compact.

.3 Overfill to allow for settlement.

.18 Upon successful commissioning and test reporting of any works completed under this contract the contractor will assist PCA with the draining of the mains and tanks for winterization of the drainage fields.

END OF SECTION

33 42 13 PIPE CULVERTS

Part 1 General

1.1 DESCRIPTION

.1 Supply and installation of CSP culverts as described in the Contract Documents and as directed by the Departmental Representative.

1.2 REFERENCES

.1 AT - Standard Specifications for Highway Construction Manual (latest edition)

.2 CSA-G401, Corrugated Steel Pipe Products.

.3 CSA-B182.8, Profile Polyethylene Storm Sewer and Drainage Pipe and Fittings.

1.3 MEASUREMENT AND PAYMENT

.1 Supply and Installation of CSP Culvert Extensions

.1 Measure for payment of CSP Culvert Extensions will be in linear metres of the types and sizes supplied, assembled, installed in accordance with the Contract Documents and accepted by the Departmental Representative.

.2 Payment will be made under **"Culvert Supply & Install (600mm CSP)"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 At locations of extensions to existing culverts, thoroughly cleaning and flushing the existing culvert ends and barrel, excavating up to 2m from present exposed end or as directed by the Departmental Representative, cutting off damaged sections of exposed end and painting remaining end with a high zinc dust oxide paint and supplying and placing a joint sealant shall be considered incidental to **"Culvert Supply & Install (600mm CSP)"** and shall include all incidentals, equipment, labour and materials required to complete the Work.

.2 Supply and Installation of CSP Culverts

.1 Measure for payment of Supply and Installation of CSP culverts will be in linear metres of the types and sizes supplied, assembled, installed in accordance with the Contract Documents and accepted by the Departmental Representative, regardless of the culvert depth.

.2 Payment will be made under **"Culvert Supply & Install (600mm CSP)"** and the price(s) bid shall be full compensation for the cost of furnishing all labour, materials, equipment, tools and incidentals necessary to complete the work as specified in the Contract Documents.

.3 Items considered incidental to the Work include, but are not limited to:

.1 The supply of bolt-type corrugated couplers and ancillary materials.

.2 Excavation.

.3 Sawcutting.

.4 Supply, loading, hauling and unloading CSP culverts.

.5 Loading, hauling and disposal of unsuitable material and CSPs.

.6 Backfill Works, including but not limited to; supply, placement and compaction of all backfill materials.

.7 Supply and installation of all culvert bedding materials.

.8 Cutting of culvert ends to satisfaction of Departmental Representative.

.9 Dewatering as required to complete the Work.

.10 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures.

.11 Couplings, fittings or end sections for CSP culverts.

.12 Survey and layout.

.13 Cleaning and disposing of material from cleaning culverts.

.4 Excavation for the types of materials encountered will be paid under the applicable Unit Price Item.

.5 Mobilization and demobilization required for this Work shall be incidental to "**Mobilization / Demobilization**", and no additional payment will be made.

.6 Traffic Control during the survey, layout and Construction of the culverts shall be incidental to "**Traffic Accommodation**" and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

.1 In accordance with Section 01 45 00 - Quality Control.

.2 Culvert roadway crossings with bumps and dips in the finished asphalt exceeding 12mm over 3m from the design grade will require remedial work to repair the deficiency as acceptable to the Departmental Representative. The Contractor is responsible for all costs associated with repairing bumps and dips from culvert crossings.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer's test data and certification.

.3 Provisions for staged construction shall be shown in the shop drawings, including any temporary support required.

.4 Certification to be marked on pipe.

1.6 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 01 61 00 - Common Product Requirements.

.2 Handle and store pipe products in a manner to avoid damage, alteration, deterioration and soiling.

.3 Store pipes on a clean and flat surface as directed by the Departmental Representative.

.4 Where the material supplied is damaged, the Contractor shall immediately separate nested sections of the plate or pipe to facilitate more detailed inspection. Culvert material designated by the Departmental Representative as unacceptable, due to damage or failure to meet specified requirements, shall be immediately repaired or replaced by the Contractor.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 In accordance with Section 01 35 43 – Environmental Procedures.

Part 2 Products

2.1 CORRUGATED STEEL PIPE

.1 Corrugated steel pipe: to CSA-G401.

.2 Culverts to be annular or spiral with annular ends. Coupling bands to be two piece annular bolted with minimum width of nine corrugations.

.3 Minimum wall thickness to be 2.0 mm.

.1 Or greater in accordance with manufactures recommendations in the specific installed conditions.

.4 Corrugations to be 68 mm x 13 mm.

.5 For all exposed culvert ends, 4:1 mitred end sections will be required.

.6 Design Code CHBDC S6-06.

.7 Design Live Load CL-800.

2.2 GRANULAR BEDDING AND BACKFILL

.1 AT Designation 2 Class 25 Base Course Aggregate for pipe bedding and backfill to be supplied by the Contractor from outside the Park.

Part 3 Execution

3.1 METHODOLOGY

.1 Contractor to verify all culvert lengths, weights, diameters and types in the field prior to ordering.

.2 Culvert installation must be coordinated with embankment construction. No payment will be made for re-excavation of embankment material required to install culverts.

.3 Pipe culvert works cannot commence until approved by the Departmental Representative.

.4 Existing culverts within the construction limits, that remain in service must be thoroughly cleaned and flushed; all sediments and bedload must be removed to the satisfaction of the Departmental Representative.

.5 If required, additional permits for pipe culvert works will be provided by Parks Canada at the request of the Contractor.

3.2 CUT ENDS

.1 All exposed ends of CSP culverts to have sloped end sections conforming to roadside slope, by cutting culvert with mechanical saw.

.2 All cut edges shall be made smooth by grinding so that all the burrs are removed. Any damaged galvanizing shall be restored by zinc metallizing in accordance with CSA G401.

.3 Where an existing culvert is extended, up to 2 m of the existing culvert end shall be removed as directed by the Departmental Representative.

3.3 BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place minimum thickness of 300 mm of approved granular material on bottom of excavation and compact to minimum 98% Standard Proctor density to ASTM D698.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.4 LAYING CORRUGATED STEEL PIPE CULVERTS

.1 Begin pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.3 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

3.5 JOINTS: CORRUGATED STEEL CULVERTS

.1 Match corrugations of coupler with pipe sections before tightening.

.2 Insert and tighten bolts.

.3 Tap couplers firmly with a rubber mallet or similar non-marring tool as they are being tightened, to take up slack and ensure snug fit.

.4 Repair spots where damage has occurred to coating in the field by applying two coats of zinc rich paint approved by the CSP supplier. Allow each coat to dry before placing second coat, bedding or backfill.

3.6 BACKFILLING

.1 Backfill around and over culverts as indicated in the Contract Documents or as directed by Departmental Representative.

.2 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.3 Compact each layer to 98% Standard Proctor density to ASTM D698 taking special care to obtain required density under haunches. Hand tamp where necessary to obtain compaction.

.4 Protect installed culvert with minimum 900 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 2H:1V.

.5 Place backfill in unfrozen condition.

3.7 CULVERT END TREATMENTS

.1 Culvert end treatments to be completed, as accepted by the Departmental Representative, prior to removing water diversions. Any scour resulting from incomplete end treatments is to be repaired by the Contractor at their cost.

3.8 TRENCHING EXISTING PAVEMENT STRUCTURES

.1 Where trenches are cut into existing pavement structures, backfill will match the existing materials and thickness.

3.9 CLEANING OF CULVERTS

.1 Known existing culverts have been indicated in the plans and are either to be removed or extended.

.2 For culverts requiring extension, remove and dispose of material from the culvert barrels and/or ends to restore proper drainage, as directed by the Departmental Representative.

.3 Removed material to be disposed as directed by the Departmental Representative.

3.10 CULVERT EXTENSIONS

.1 Extensions to existing culverts shall be as noted in the Contract Documents.

.2 All culverts are believed to be 600mm diameter or less. Contractor shall confirm existing pipe sizes prior to ordering materials to site.

.3 Culverts shall be cleaned prior to extensions being installed.

3.11 CULVERT REMOVAL

.1 Culvert removal shall be as indicated in the Contract Documents and shall include disposal of sections to a suitable disposal facility outside of the National Parks.

3.12 STREAM AND CHANNEL DIVERSIONS

.1 Temporary stream and channel diversions shall be in accordance with Section 01 35 43 – Environmental Procedures.

END OF SECTION

Appendix A

Building Specification Manual – Parks Canada – Crandell Mountain Campground Waterton Lakes National Park - Issued for Tender

APPENDIX “A”
PHASE 1 - FOUNDATIONS
PARKS CANADA
Crandell Mountain Campground
Waterton Lakes National Park

Issued for Tender
January 26, 2021

NORR
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SPECIFICATIONS GROUP

END TABLE OF CONTENTS

1 SUMMARY OF WORK

.1 Construction of various new buildings at Waterton Lakes National Park, Alberta.

.2 Work includes, but is not limited to the following:

- .1 Excavation and foundations for the following buildings:
  - .1 Amphitheatre
  - .2 Concession Building
  - .3 Firewood Storage
  - .4 Gate House
  - .5 Half Open Kitchen
  - .6 Privy
  - .7 Washrooms
  - .8 Winter Kitchen
- .2 Mechanical and electrical rough-ins as indicated.

2 PROJECT CO-ORDINATION

2.1 Site Examination

.1 Visit the site and compare drawings and specifications with existing conditions, including all conditions surrounding the site prior to submitting bids.

.2 Failure to visit the site will not relieve the Contractor from supplying any materials or performing any work in accordance with drawings and specification, without additional cost the Departmental Representative.

.3 Submission of bid will be deemed to be evidence that the Contractor has examined the site and is familiar with conditions under which work will be performed.

2.2 Co-ordination

.1 Co-ordinate progress of the work, construction schedules, submittals, use of the site, temporary utilities, construction facilities and controls.

.2 Ensure work is co-ordinated and scheduled to minimize conflicts between trades and to avoid delays.

.3 Notify trades of readiness for their Work and to allow adequate time for preparation and installation.

.4 Examine drawings, specifications, existing conditions and report to the Departmental Representative, in writing, any omissions or irregularities that may affect the performance of the work. In the absence of any such report, the Contractor and all trades will be held to have waived all claims to extra costs for performance of the work.

.5 Supply all items to be built-in, including anchors, ties, nailing strips, blocks, bolts, sleeves and any other miscellaneous items, together with any templates, measurements and shop drawings.

.6 Establish correct locations of sleeves, inserts, hangers, holes and chases.

2.3 Diagrammatic Locations

.1 Check and verify all dimensions as work proceeds.

.2 Un-dimensioned locations of equipment indicated or specified are to be considered as approximate. Confirm all un-dimensioned locations prior to beginning any installation.

.3 Where locations or holes in structural elements may possibly affect the nature or strength, inform the Departmental Representative prior to beginning any work.

.4 Inform Departmental Representative of impending installation of items of work that are diagrammatically indicated on the drawings, and obtain acceptance of actual locations.

.5 Submit field drawings to indicate relative locations of various services and equipment as required by Departmental Representative.

2.4 Smoking

.1 Do not allow any personnel to smoke in the building or on the surrounding site. Anyone found smoking will be immediately asked to leave the site.

2.5 Harassment

.1 All personnel working at this site must comply with the following harassment guidelines to prevent conduct defined as harassment.

.2 Harassment is defined as unwanted attention by actions or in oral, written, or graphic form. Any conduct which creates an offensive or intimidating environment is also considered Harassment.

.3 All Subcontractors and Suppliers shall be familiar with these requirements and ensure that no conduct which could be considered as Harassment occurs on this Project.

.4 All site offices, storage areas, and the entire construction site shall be deemed public spaces for the purposes of this definition.

2.6 Responsibility for Existing Property

.1 Assume responsibility for the care, custody and control of property which is assigned for performance of the Work.

.2 Assume responsibility for and repair damage to existing property attributable to performance of Work of this Contract.

.3 Request permission to load materials on to the structure where such loading would possibly affect the nature or strength of the structure.

2.7 Cutting and Patching

.1 Do not cut, bore or sleeve any structural elements without the written acceptance of Departmental Representative.

.2 Submit written request in advance of cutting or alteration which affects the following:

- .1 Structural integrity of any element of the Project,
- .2 Integrity of weather-exposed or moisture-resistant elements,
- .3 Efficiency, maintenance, or safety of any operational elements,
- .4 Visual qualities of sight-exposed elements, or
- .5 Work of Departmental Representative or separate contractor as applicable.

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

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

.5 Perform cutting, fitting, and patching, including excavation and backfilling, to complete the Work.

.6 Cut and drill with true, smooth edges and to minimum suitable tolerances. Do not oversize holes.

.7 Perform work to avoid damage to other work.

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

.9 Provide protection from elements for areas that may be exposed by uncovering work.

.10 Prepare surfaces to receive patching and finishing.

.11 Cut rigid materials using power saw or core drill, except as otherwise noted. Pneumatic or impact tools not allowed without approval.

.12 Restore work with new products in accordance with the Contract Documents.

3 FIELD ENGINEERING

3.1 Laying Out of Work

.1 Establish lines and levels, locate and layout, by instrumentation.

.2 Verify all lines, levels, datum and dimensions shown on drawings and report errors or inconsistencies to the Departmental Representative prior to commencing work. Failure to do so does not relieve the Contractor from responsibility of correcting same.

.3 Lay out work to lines and levels as indicated on drawings. In all cases, figured dimensions will overrule scaled dimensions.

.4 Exercise every possible precaution to verify figures shown on drawings and to obtain from Departmental Representative any additional dimensions or information as required before laying out the work. Be responsible to rectify any errors or incorrect work due to failure to exercise such precautions.

4 PROJECT MEETINGS

4.1 Administrative

.1 Schedule and administer project progress meetings throughout the course of the work as specified in Section 01 31 19.

5 SUBMITTALS

5.1 Administrative

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

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

.3 Review submittals prior to submission. Review by the Contractor represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project shall be returned without being examined and shall be considered rejected.

.4 Review of shop drawings by the Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept and for general arrangement only. This review does not mean approval of the detail design inherent in the shop drawings, responsibility for which remains with the Contractor submitting same. Such review does not relieve responsibility for errors, omissions or deviations in shop drawings or samples or of responsibility

for meeting all requirements of the Contract Documents, unless a deviation has been accepted in writing by the Departmental Representative.

.5 Verify field measurements and affected adjacent Work are coordinated.

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

5.2 Materials List

.1 Furnish a detailed list of materials and equipment complete with names of suppliers within five working days of Contract award.

5.3 Shop Drawings and Product Data

.1 Shop Drawings:

.1 Mark drawings with name of project, specification section number, drawing detail and sheet number referenced where subject of shop drawing is described and shown, and date shop drawing was prepared and/or revised.

.2 Where coordination requirements necessitate scope of shop drawing to include more than one item, label shop drawings with specification section number of dominant trade involved. "Dominant" shall be defined as greatest quantity, greatest cost, or principal detail subject of drawing, whichever may be appropriate.

.3 Shop drawings augment, but do not supersede the Contract Documents. Review of shop drawings does not imply acceptance of Work.

.4 Submit shop drawings for each requirement requested in specification sections and as the Departmental Representative may reasonably request. Submit electronic pdf files of shop drawings.

.5 Prepare shop drawings using a qualified detailer.

.6 Submit electronic pdf files of product data sheets or brochures for requirements requested in specification sections and as the Departmental Representative may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.7 Clearly indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such articles and equipment have been properly co ordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Indicate cross references to design drawings and specifications.

.8 Where shop drawings vary from requirements of Contract Documents as result of standard shop practice, changes in materials and methods or other reason, clearly point out variations on shop drawings.

.9 Adjustments made on shop drawings by the Departmental Representative are not affect the value of Work, request issue of a Change Order before proceeding with the Work.

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

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

.12 Upon completion of the review, the Departmental Representative shall retain one print and forward the remaining copies to Contractor for distribution.

.13 Identify details by reference to sheet and detail number shown on Contract Drawings.

.14 Provide shop drawings for one trade as one complete set. Do not provide shop drawings in a "piece meal" fashion, i.e. provide miscellaneous metal shop drawings for different handrails at different times. Accompany shop drawings with letter of transmittal listing numbers and latest dates of drawings submitted.

.15 Do not copy the contract documents for the purpose of shop drawing production, unless directed otherwise by the Departmental Representative.

.16 Any proposed deviations from the Contract Documents must be boldly indicated as such on the shop drawings. No acceptance shall be inferred or assumed otherwise.

.2 Product Data:

.1 Certain specification sections specify that manufacturers' standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted as shop drawings. Refer to individual trade sections for specific requirements.

.2 The above will only be accepted if they conform to the following:

.1 Delete information which is not applicable to project.
.2 Supplement standard information to provide additional information applicable to project.
.3 Show dimensions and clearances required.
.4 Show performance characteristics and capacities.
.5 Show wiring diagrams and controls where applicable.

.3 Manufacturer's standard schematic drawings:

.1 Modify drawings to delete information which is not applicable to the project.

.2 Supplement standard information to provide additional information applicable to the project.

.3 Manufacturer's catalogue sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data.

.4 Clearly mark each copy to identify pertinent materials, products or models.

.5 Show dimensions and clearances required.

.6 Show performance characteristics and capacities.

.7 Show wiring diagrams and controls where applicable.

5.4 Samples

.1 Submit for review samples in duplicate as the Departmental Representative may reasonably require or as requested in the respective specification sections.

.2 Identification:

.1 Label samples with name of project, supplier's name, Subcontractor's name, generic name of item, manufacturer's name, brand name and model number.

.2 Accompany sample shipments with transmittal letter referencing name of project, drawing sheet detail, specification section and paragraph number, and same information with which sample itself is labelled.

.3 Deliver samples prepaid to the Contractor’s business address.

.4 Provide samples of special products, assemblies, or components when so specified.

.5 Submit samples with reasonable promptness and in an orderly sequence, so as to cause no delay in the Work. Failure to submit samples in ample time will not be considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed. If requested, the Departmental Representative will assist in preparing a schedule fixing the dates for submission.

.6 Submit samples in ample time for the Departmental Representative's review prior to quantity fabrication, or in the case of manufactured items, prior to placement of purchase orders.

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

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

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

.10 The accepted samples establish the material standards for the work. No deviation permitted after review of samples. Label samples as to origin and intended use in the work.

5.5 Operation and Maintenance Manuals

.1 Manual:

.1 An organized compilation of operating and maintenance data including detailed technical information, documents, and records describing operation and maintenance of individual products or systems as specified in individual sections.

.2 Divide the manual into three volumes to address care taking, shop drawings, and mechanical and electrical systems as noted in this section.

.2 General

.1 Assemble, co-ordinate, bind and index required data into Operation and Maintenance Manual.

.2 Submit complete operation and maintenance manual to Departmental Representative two (2) weeks prior to application for Substantial Performance.

.3 Submit one (1) copy of each required volume in English language language and one (1) pdf copy on a CD.

.4 Organize data into systems and not in numerical order as contract specifications.

.5 Label each section with tabs protected with celluloid covers fastened to hard paper dividing sheets.

.6 Type lists and notes.

.7 Drawings, diagrams and manufacturers literature must be legible.

.3 Binders

.1 Binders: 3 “D” ring type binders bound with heavy vinyl, with clear vinyl pocket on front cover and spine, sized for 215 x 280 mm paper. Binders must not exceed 75 mm thick or be more than 2/3 full. Include a slip sheet in vinyl pockets indicating the following only:

Name of Project.
Date of Project Completion
Volume 1 – Record Documents, or Volume 2 – Maintenance Documents
Submissions with any additional information will be rejected by the Departmental Representative.

.4 Binder contents:

.1 Record Documents by Specification Division: Shop drawings and product submittals shall contain the following:

Cover sheet containing:
Date submitted.
Project title, location and project number.

Table of Contents of individual binder.
Bind separately one complete set of reviewed final shop drawings and product data in English language only.

.2 Maintenance Documents by Specification Division: Care taking and cleaning instructions for finish materials, and operating and maintenance instructions for mechanical and electrical systems, and shall contain the following:

Cover sheet containing:

Date submitted.
Project title, location and project number.
Names and addresses of Contractor, and all Subcontractors.
Table of Contents of all binders.
Warranties, guaranties relating to equipment.
Copies of approvals, and certificates.
Manufacturer's recommended care taking practices for specified interior and exterior finishes.
Manufacturer's recommended cleaners and equipment required for care taking.
List of all finish materials and locations used on the project, relate actual materials used with specified materials.
List of suppliers, phone numbers and addresses.
All warranties, guaranties relating to care taking materialsOperation data to include:
Control schematics for each system including environmental controls.
Description of each system and its controls.
Description of operation of each system at various loads together with reset schedules and seasonal variances.
Operation instruction for each system and each component.
Description of actions to be taken in event of equipment failure.

.3 Maintenance data shall include:

Cleaning and maintenance of all finishes and surfaces.
Servicing, maintenance, operation and troubleshooting instructions for each item of equipment.
Data to include schedules of tasks, frequency, and tools required and task time.

.4 Performance data to include:

Equipment manufacturer's performance data sheets with point of operation as left after facility systematic testing & balancing is complete.
Equipment performance verification test results.
Special performance data as specified elsewhere.

.5 Approvals

.1 Submit draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.

.2 Make changes as required and resubmit as directed by Departmental Representative

5.6 Record Drawings

.1 Departmental Representative will provide one set of prints for record drawing purposes.

.2 Maintain project record drawings and record accurately deviations from Contract documents.

.3 Make recordings immediately after the respective Work is completed and not less than once a week. Each recording shall be dated.

.4 Mark changes in red.

.5 Record following information:

.1 Depths of various elements of foundation in relation to main floor slab datum and survey monument.

.2 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.

.3 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.

.4 Field changes of dimension and detail.

.5 Changes made by Change Order or Field Order.

.6 Drawing format:

.1 At completion of project and prior to final inspection, submit record prints to Departmental Representative.

.2 Substantial Performance of the Contract is dependent upon submission of record drawing information.

.3 Contractor will be responsible for providing accurate as-built information. Where the Departmental Representative finds that information provided by the Contractor is inaccurate through testing or site investigation, Contractor will be responsible for paying for updating Departmental Representative's Record Drawings.

6 SCHEDULES

6.1 Schedules Required

.1 Submit schedules as specified in Section 01 32 16.07

7 QUALITY CONTROL

7.1 Products and Materials

.1 Quality:

.1 Products, materials and equipment incorporated into the work shall be new, not damaged or defective and of the best quality consistent with the Contract Documents and for the purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

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

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

.4 Unless otherwise specified, maintain uniformity of manufacture for any particular or like item throughout the building.

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

.2 Availability:

.1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any item. Notify Departmental Representative in writing of any anticipated delays in sufficient time to allow for substitution or other remedial work without delaying performance of the work.

.2 In the event of failure to notify Departmental Representative in sufficient time and should it appear that work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in Contract Price.

7.2 Storage, Handling and Protection

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

.2 Store packaged or bundled products in original, undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required for incorporation into the work.

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

.4 Store wood products on solid supports and keep clear of ground. Slope to shed moisture.

.5 Store and mix paints in a heated and ventilated area. Remove oily rags and other combustible debris from site daily. Take precautions to prevent spontaneous combustion.

7.3 Manufacturer's Instructions

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

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

.3 Remove and reinstall improperly installed or erected products at no increase in Contract Price.

7.4 Workmanship

.1 General:

.1 Work shall be executed by workers experienced and skilled in their respective duties for which they are employed. Immediately notify the Departmental Representative if required work is such as to make it impractical to achieve required results.

.2 Decisions as to the quality or fitness of workmanship in cases of dispute rests solely with the Departmental Representative.

.3 Coordination:

.1 Coordinate and ensure cooperation of workers in laying out work. Maintain efficient and continuous supervision.

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

.4 Fastenings:

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

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dipped galvanized steel fasteners and anchors for securing exterior work, unless indicated otherwise.

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

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

.6 Fastenings that cause spalling or cracking of material to which anchorage is made is not acceptable.

8 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

8.1 Installation and Removal

.1 Provide construction facilities and temporary controls in order to execute the work expeditiously.

.2 Remove from site all such work after use.

.3 Remove barriers prior to completion and final acceptance. Patch and repair surfaces to original condition damaged by erection of barriers.

8.2 Guard Rails and Barricades

.1 Provide all other temporary safeguards and protection to adequately protect against accident or injury to workers or other personnel on the site.

.2 Neatly assemble and firmly brace.

.3 Maintain as required during construction period.

.4 Remove barriers prior to completion and final acceptance. Patch and repair surfaces to original condition damaged by erection of barriers.

8.3 Scaffolding and Tools

.1 Provide and maintain scaffolding, ramps, ladders, swing stages, platforms, temporary stairs, tools required for the completion of the Work, and coordinate all types of scaffolding, etc., required by various trades.

.2 Subcontractors are responsible for their own scaffolding, swing stages.

8.4 Equipment/Tool/Materials Storage

.1 Provide and maintain, in a clean and orderly condition, lockable storage lockers or storage area suitable for storage of tools, equipment and materials.

.2 Do not deliver materials to site until work has progressed enough for immediate installation.

.3 Padlocked temporary doors to be installed for security.

8.5 Protection

.1 Take precautions at all times to protect persons, including the public, Contractor's employees, subcontractor's and their employees, and property affected in any way by the work. Especially guard against or eliminate hazardous conditions.

.2 Protect surrounding property from damage during performance of the Work.

.3 Be responsible for damage incurred.

8.6 Protection of Building Finishes and Equipment

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

.2 Be responsible and pay all costs for repair of damage incurred due to lack of or improper protection.

8.7 Project Cleanliness

.1 Maintain the Work in tidy condition, free from the accumulation of waste products and debris.

.2 Maintain areas free of dust and other contaminants during finishing operations.

.3 Store waste materials within the confines of the site hoarding.

8.8 Completion

.1 On completion of the work, remove all temporary protection erected under the section, make good all damage to this work and adjoining work resulting from the execution of the work, and remove from the premises all surplus materials and debris, and all tools, plant, and equipment. Leave the building and site in a clean tidy condition satisfactory to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA-A23.1- Concrete Materials and Methods of Concrete Construction.

.2 CSA-A23.2- Test Methods and Standard Practices for Concrete

.3 CSA-S269.3 - Concrete Formwork

.4 CSA S269.1- Falsework for Construction Purposes.

.5 CAN/CSA-S269.3- Concrete Formwork.

.2 A copy of the latest A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.2 SHOP DRAWINGS

.1 Submit shop drawings for formwork and falsework.

.2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.

.3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

.4 Indicate sequence of erection and removal of formwork/falsework.

.5 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Alberta, Canada.

Part 2 Products

2.1 MATERIALS

.1 Form Material

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CSA-O86.1, CSA O437, and Series CSA-O153.

.2 For concrete with special architectural features, use formwork materials to CSA-A23.1 and CSA-A23.2.

.3 Exposed surfaces - metal, plywood or plywood lined. Plywood to conform to the Standard.

.4 Unexposed surfaces - metal, plywood, or wood lumber to conform to the Standard.

.5 Plywood and wood formwork materials shall, conform to the Standard, be free from warp and sawn straight so that lines and shapes will be accurately retained.

.6 Un-lined forms for unexposed surfaces shall be made with a good grade of lumber or plywood and fitted so that there will be no leakage of mortar.

.7 Use metal forms, plywood lined forms or plywood forms of sufficient structural strength for exposed surfaces. Plywood for lining shall be GIS exterior grade fir plywood with waterproof glue.

.8 Proprietary and/or modular forming systems shall be designed such that they do not interfere with the specified placement of reinforcement or other embedded hardware and must be pre-approved by the Consultant.

.2 Ties and Spreaders

.1 Use metal form ties that are adjustable in length to permit tightening of forms. Use only the snap-off type of form ties which will permit no metal within 25mm (1") of the concrete surface after removal. Twisted wire form ties will not be accepted.

.2 Wood spreaders inside wall forms will not be permitted.

.3 Form Release and Stripping Agents

.1 Use a non-staining, non-toxic, biodegradable, low VOC form release agent that is compatible with any finishes specified elsewhere in the contract documents.

.4 Void Form

.1 Void form shall be of a deteriorating material.

Part 3 Execution

3.1 GENERAL

.1 All phases of concrete formwork construction shall be in accordance with the Standard unless otherwise specified herein or on the drawings. Only workers who are skilled and experienced in their trade shall do the work.

3.2 LINES AND LEVELS

.1 Verify lines, levels and column centers before proceeding with work and ensure that dimensions agree with drawings.

.2 Co-ordinate and co-operate with all other trades in forming and setting of recesses, chases, sleeves, inserts, bolts, and hangers.

3.3 DESIGN OF FORMWORK, FALSEWORK AND RESHORING

.1 The Contractor shall assume full responsibility for the structural adequacy of the forms to withstand all concrete, environmental, and construction loads.

.2 As a minimum, the work shall conform to CSA-A23.1, Section 6.5 for regular work and Section 8.3.4 for architectural concrete.

.3 Where concrete is exposed to view, forms are to be laid out so that joints are kept to a minimum and located in an orderly and symmetrical arrangement wherever possible. Form ties shall be evenly spaced and located in straight horizontal and vertical lines. Spacing and location of form tie holes shall be detailed by the Contractor and approved. See also the architectural drawings and specifications for any special requirements for architectural concrete.

.4 The strength and rigidity of forms shall be such that they will not leak mortar or result in visible irregularities in the finished concrete. In addition, the deflection of facing materials between studs, as well as the deflection of studs and whalers, shall not exceed 0.0025 times the span.

.5 Forms shall be so constructed that the finished concrete will conform to the shape, dimensions and tolerances as specified in the standard or on the structural drawing, whichever is most rigorous. They shall also incorporate the cambers specified on the structural drawings. Movement resulting from form support deflection, closure of form joints, and elastic shortening of forms and shoring, must be calculated and added to the cambers indicated on the drawings.

.6 Construct forms so that they may be dismantled and removed without damaging the concrete.

.7 The Contractor shall submit details of the sequence and extent of formwork removal and re-shoring to the Departmental Representative for review. Such details shall include magnitude of loads and location of all re-shores at each level. Forms shall not be removed or adjusted until the review is complete. Such review does not relieve the Contractor of responsibility for formwork and safety during construction.

.8 Set shores on wedges or use adjustable shores so they may be removed without causing undue strains in the concrete.

.9 Do not exceed the safe capacity of the structure with any construction or shoring loads. The safe capacity of the structure may be taken as the design live load, as indicated on the structural drawings, multiplied by the ratio of the concrete strength at the time of loading to the specified concrete strength, but not greater than 1.0.

3.4 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain approval or use of earth forms framing openings not indicated on drawings. Earth forming for precast concrete is not allowed.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.

.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes. Earth forming for precast concrete is not allowed.

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

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

.8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1 and CSA-A23.2.

.9 Align form joints and make watertight. Keep form joints to minimum.

.10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.11 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.12 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.13 Sleeves and openings shown on the structural drawings must be confirmed with mechanical, electrical and architectural drawings. Any discrepancies are to be reported.

.14 Sleeves and openings not shown on the structural drawings must be approved.

.15 Keep all untreated forms moist to prevent shrinkage prior to placing of concrete and wet the surface at time of placing.

.16 Treated formwork surfaces shall have the approved form coating applied in accordance with the manufacturer's recommendations, prior to placing reinforcing steel. Remove any excess form coating.

3.5 TOLERANCES

.1 The tolerances for all concrete work shall conform to the requirements of the Standard and Drawings.

3.6 PRODUCT HANDLING

.1 Protect formwork materials before, during and after installation and protect installed work and materials of other trades.

.2 In the event of damage, immediately make required repairs or replacements necessary for approval at no extra cost.

3.7 REMOVAL AND RESHORING

.1 Forms shall not be removed until concrete has attained sufficient strength that no damage to strength or continuity of concrete will occur when forms are removed. Time for formwork removal of suspended concrete shall be approved.

.2 Prying against face of concrete to remove forms is not allowed, only wooden wedges shall be used.

.3 Removal of form ties shall be done carefully to avoid marking concrete and to allow for patching. Grout bottom of form tie hole to prevent rust staining.

.4 Remove formwork when concrete has reached its design strength or minimum approved period, whichever comes later, and replace immediately with adequate reshoring.

.5 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.6 Space reshoring in each principal direction at not more than 3000 mm apart.

.7 Re-use formwork and falsework subject to requirements of CSA-A23.1 and CSA-A23.2.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual.

.2 ASTM International

.1 ASTM A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 CSA International

.1 CSA-A23.1 A23.2- Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3- Design of Concrete Structures.

.3 CSA-G30.18- Carbon Steel Bars for Concrete Reinforcement.

.4 CSA-G40.20/G40.21- General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CSA W186-M- Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC- Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 00 15.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province Alberta of Canada.

.1 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

.1 Provide type B unless otherwise indicated.

.4 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.

1.3 QUALITY ASSURANCE

.1 Submit in accordance with Section 01 00-15 – Quality Control.

.1 Mill Test Report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Departmental Representative.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.

.4 Welded steel wire fabric: to ASTM A185/A185M.

.1 Provide in flat sheets only.

.5 Welded deformed steel wire fabric: to ASTM A82/A82M.

.1 Provide in flat sheets only.

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

.7 Mechanical splices: subject to approval of Consultant.

.8 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.1 SP-66 unless indicated otherwise.

.2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Departmental 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 Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

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

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

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

.2 Use plain round bars as slip dowels in concrete.

.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 When paint is dry, apply thick even film of mineral lubricating grease.

.3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

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

.5 Protect paint coated portions of bars with covering during transportation and handling.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Abbreviations and Acronyms:

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.

.1 Type GU, GUb and GUL - General use cement.

.2 Reference Standards:

.1 ASTM International

.1 ASTM C260/C260M- Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309- Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M- Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017/C1017M- Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D412- Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.6 ASTM D624- Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.7 ASTM D1751- Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.8 ASTM D1752- Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Damp-proofing and Waterproofing and for Roof Coatings.

.3 CSA International

.1 CSA A23.1/A23.2- Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283- Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000- Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 00 15.

.2 At least 4 weeks prior to beginning Work, provide Departmental Representative with samples of materials proposed for use as follows:

.1 5 L of curing compound.

.2 1 m length of each type of joint filler.

.3 1 m length of each type of water-stops.

.4 3 kg of each type of supplementary cementing material.

.5 10 kg of each type of blended hydraulic cement.

.6 5 kg of each admixture.

.7 1 kg of each fine and coarse aggregate.

.3 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.

.4 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.5 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 15 00 - Quality Control.

.2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

.4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of work and discharged within 120-minutes maximum after batching.

.1 Do not modify maximum time limit without receipt of prior written agreement from concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Departmental Representative.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

.1 Portland Cement: to CSA A3001, Type GU.

.2 Water: to CSA A23.1.

.3 Aggregates: to CSA A23.1/A23.2.

.4 Admixtures:

.1 Air entraining admixture: to CAN3-A266.1.

.2 Chemical admixture: to CAN3-A266.2

.5 Curing compound: to CSA A23.1/A23.2.

.6 Polyethylene film: 150 micrometre thickness, to CAN/CGSB-51.34.

2.4 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria to CSA A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.2 Provide concrete mix to meet the Performance Alternative outlined in Table 5 of CAN/CSA-A23.1

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: C-1

.2 Compressive strength at 28-days age: 35 MPa minimum.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

.5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Departmental Representative's written approval before placing concrete.

.1 Provide 24 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after approval of equipment and mix.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature, and test samples taken.

.10 In locations where new concrete is dowelled to existing work, drill holes in existing

.11 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.

.2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Consultant.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Consultant before placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor bolts:

.1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.

.2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.

.1 Formed holes: 100 mm minimum diameter.

.2 Drilled holes: to manufacturers' recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with epoxy grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

.6 Finishing and curing:

.1 Finish concrete to CSA A23.1/A23.2.

.2 Use procedures as reviewed by noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

.3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

.4 Provide screed is to be applied.

.5 Provide screed finish unless otherwise indicated.

.6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

.7 Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat sealed butt joints in field.

.7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.

.8 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Consultant.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.9 Dampproof membrane:

.1 Install dampproof membrane under concrete slabs-on-grade inside building.

.2 Lap dampproof membrane minimum 150 mm at joints and seal.

.3 Seal punctures in dampproof membrane before placing concrete.

.4 Use patching material at least 150 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1.

3.4 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 28 days.

.5 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated to CSA A23.1/A23.2.

.1 Ensure testing laboratory is certified to CSA A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative

.4 Departmental Representative will pay for costs of tests as specified in Section [01 29 83 - Payment Procedures for Testing Laboratory Services.

.5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.7 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

END OF SECTION

Part 1. General

1.1. SUMMARY

1. This Section includes the following:
    1. Excavating and backfilling for site demolition and preparation
    2. Excavating and backfilling for utility trenches
    3. Excavation and backfilling for structures
    4. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures

1.2. REFERENCES

1. American Society for Testing and Materials (ASTM):
    1. ASTM D69800ae1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ftlbf/ft^3 (600 kNm/m^3))
    2. ASTM C11704 Test Method for Material Finer Than: 0.075 mm Sieve in Mineral Aggregates by Washing.
    3. ASTM C13604 Method for Sieve Analysis of Fine and Coarse Aggregates
    4. ASTM D155702e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ftlbf/ft^3(2,700 kNm/m^3))
2. Canadian General Standards Board (CGSB):
    1. CAN/CGSB 8.188 Sieves Testing, Woven Wire, Inch Series
    2. CAN/CGSB 8.2M88 Sieves, Testing, Woven Wire, Metric
3. Canadian Standards Association (CSA):
    1. CSAA23.1/A23.200 Concrete Materials and Methods of Concrete Construction/Methods of Tests for Concrete

1.3. DEFINITIONS

1. Backfill: Soil material or controlled low strength material used to fill an excavation
    1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe
    2. Final Backfill: Backfill placed over initial backfill to fill a trench
2. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe
3. Borrow Soil: Satisfactory soil imported from off site for use as fill or backfill
4. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated
5. Authorized Additional Excavation:
    1. Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by geotechnical Departmental Representative

2. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work

6. Unauthorized Excavation:

1. Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by geotechnical Departmental Representative

2. Unauthorized excavation, as well as remedial work directed by geotechnical Departmental Representative, shall be without additional compensation

7. Common Excavation: Excavation of materials of whatever nature, which can be ripped and excavated with heavy construction equipment

8. Rock Excavation: Excavation of material from solid masses of igneous, sedimentary of metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m^3

9. Fill: Soil materials used to raise existing grades

10. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below the ground surface

11. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill

12. Topsoil: Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding

13. Utilities: On site underground pipes, conduits, ducts, and cables, as well as underground services within buildings

1.4. SUBMITTALS

1. Comply with requirements of Section 01 00 15.

2. Submit drawings indicating all required shoring and related work. Drawings must bear the seal of the Professional Engineer responsible for the shoring design.

3. Submit a drawing indicating required underpinning, construction methods and sequences. The drawing must bear the seal of a Professional Engineer responsible for the underpinning design.

4. Submit soil density test results and soil engineer reports before placing footings or slab on grade.

5. Samples: At least 2 weeks prior to commencing work, inform Departmental Representative of proposed source of fill materials and provide access for sampling; provide testing agency with 70 kg samples of type of fill specified.

1.5. QUALITY ASSURANCE

1. Refer to Section 31 24 19 for materials testing and quality control.

1.6. PROJECT CONDITIONS

1. A geotechnical report will been prepared for this Project and made available for viewing under the following conditions:
    1. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer.
    2. Departmental Representative will not be responsible for interpretations or conclusions drawn from the report.
    3. Departmental Representative has used the information for their own design purposes, and will not be responsible for further interpretations or conclusions drawn from the report.
    4. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. Do not interrupt utilities serving facilities occupied by Departmental Representative or others unless permitted in writing by Departmental Representative and then only after arranging to provide temporary utility services according to requirements indicated.
3. Size, depth and location of existing utilities and structures as indicted are for guidance only. Completeness and accuracy are not guaranteed.
4. Prior to commencing any excavation work, notify Departmental Representative, establish location and state of use of buried utilities including existing communication and security lines and structures. Clearly mark such locations to prevent disturbance during work. Immediate restoration and replacement of any damaged equipment or lines will be imposed at the Contractor's expense.
5. Confirm locations to buried utilities by careful test excavations.
6. When directed, reroute existing lines in area of excavation. Pay costs for such work.
7. Record location of maintained, rerouted and abandoned underground lines.
8. Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracts and paving, survey benchmarks and monuments which may be affected by work.
9. Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.
10. Where the excavation necessitates root or branch cutting, do so only as approved by Departmental Representative.

1.7. WARRANTY

1. The Contractor will be responsible for all reinstatement of surface paving, slabs, etc. due to settlement for 2 years from date of Substantial Performance.

Part 2. Products

2.1. SOIL MATERIALS

1. General:
    1. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
    2. Coordinate with geotechnical Departmental Representative for types of fill materials required for the Project.
2. SiteExcavated Material:
    1. Site excavated soil, where approved as backfill and fill material, is to be free of debris, organic matter, snow and ice. Do not use frozen soil for fill.
    2. Site excavated soil is to include only site material removed by required excavation and grading.
3. Granular Backfill and Fill Material:
    1. Where backfill or fill material is required to be pitrun gravel, crushed gravel, or sand, it is to be a clean natural stone. Do not exceed 2% organic content; gradation is to be within the specified limits.
4. PitRun Gravel A:

Sieve Size (mm)	Percent Passing By Weight	
100	100	
75	60 100	Total Sample
25	60 80	
2.36	25 45	Material Passing
1.18	16 25	75 mm Sieve
0.60	8 18	
0.150	4 10	
0.075	2 6	

5. PitRun Gravel B:

Sieve Size (mm)	Percent Passing By Weight
80	100
50	55 100
25	38 100
16	32 85
5	20 65
0.35	6 30
0.080	2 15

6. Crushed Gravel A:

Sieve Size (mm)	Percent Passing By Weight
25	100
20	95 100
10	60 80
4.75	40 60
2.36	28 48
0.60	13 29
0.15	6 15
0.075	4 10

7. Crushed Gravel B:

Sieve Size (mm)	Percent Passing By Weight
25	100
20	100
12.5	60 92
5	37 62
2	26 44
0.40	12 27
0.16	7 18
0.08	2 8

8. Coarse Gravel:

Sieve Size (mm)	Percent Passing By Weight
50	100
40	90 100
20	35 70
10	10 30
4.75	0 5

9. Sand A:

Sieve Size (mm)	Percent Passing By Weight
10	100
4.75	95 100
1.18	50 85
0.60	25 60
0.30	10 30
0.15	2 10

10. Sand B:

Sieve Size (mm)	Percent Passing By Weight
10	65 100
5.0	50 90
2.0	35 75
0.4	10 45
0.15	0 20
0.080	0 10

Part 3. Execution

3.1. PREPARATION

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
2. Preparation of sub-grade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.
3. Protect and maintain erosion and sedimentation controls during earthwork operations.
4. Protect sub-grade from softening, undermining, washout, and damage by rain or water accumulation as follows:
    1. Reroute surface water runoff away from excavated areas
    2. Do not allow water to accumulate in excavations
    3. Do not use excavated trenches as temporary drainage ditches
    4. Maintain until dewatering until it is no longer required

3.2. GENERAL EXCAVATION

1. It is not expected that any unclassified excavated materials will be encountered during excavation operations:
    1. Unclassified excavated materials may include rock, soil materials not reported in geotechnical investigation, and sub-grade obstructions not indicated on drawings or in specifications.
2. Excavate to sub-grade elevations indicated on drawings including foundation elements and building obstructions resulting from demolition of existing building and site features to a tolerance of ± 25 mm (1”).
3. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

4. Support excavations having an angle of repose greater than that allowable for the soil types in accordance with requirements.

3.3. EXCAVATION FOR UTILITY TRENCHES

1. Excavate trenches to indicated gradients, lines, depths, and elevations.
2. Excavate trenches to allow installation of top of pipe below frost line, where they occur beyond building perimeter.
3. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit:
    1. Excavate trench walls vertically from trench bottom to 305 mm (12”) higher than top of pipe or conduit
    2. Clearance: 305 mm (12”) each side of pipe or conduit.
4. Trench Bottoms:
    1. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit.
    2. Shape sub-grade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
    3. Remove projecting stones and sharp objects along trench sub-grade.
    4. Hand excavate trench bottoms for pipes and conduit, and flat bottomed and multiple duct conduit units < 150 mm (6”) Ø nominal, and support pipe and conduit on an undisturbed sub-grade.
    5. Shape bottom of trench to support bottom 90 degrees of pipe circumference for pipes and conduit 〈150 mm (6”) Ø nominal and fill depressions with tamped sand backfill.

3.4. STRUCTURE EXCAVATION

1. Excavate to elevations and dimensions indicated on Drawings within a tolerance of ±50 mm, and extending a sufficient distance from footings and foundation walls to permit placing and removal of concrete formwork, installation of services, other required construction, and for inspection.
2. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
3. Protect bottom of excavations and soil around and beneath footings from frost and ingress of water.

3.5. SUB-GRADE INSPECTION

1. Notify Departmental Representative when excavations have reached required sub-grade.
2. Continue excavation and replace with compacted backfill or fill material as directed where geotechnical Departmental Representative determines that unsatisfactory soil is present.

3. Proof roll sub-grade below the building slabs and pavements with heavy pneumatic tired equipment to identify soft pockets and areas of excess yielding using equipment acceptable to the geotechnical Departmental Representative; do not proof roll wet or saturated sub-grade, and as follows:

    1. Proof roll in direction and speed as directed by geotechnical Departmental Representative.

    2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by geotechnical Departmental Representative, and replace with compacted backfill or fill as directed.

4. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

5. Reconstruct sub-grade damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by geotechnical Departmental Representative, without additional compensation.

3.6. UNAUTHORIZED EXCAVATION

1. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation or other method as directed by the geotechnical Departmental Representative.

2. Fill unauthorized excavations under other construction or utility pipe as directed by geotechnical Departmental Representative.

3.7. STORAGE OF SOIL MATERIALS

1. Stockpile topsoil and other acceptable fill materials in locations as directed by Departmental Representative.

3.8. UTILITY TRENCH BACKFILL

1. Place backfill on sub-grade free of mud, frost, snow, or ice.

2. Place and compact bedding course on trench bottoms and where indicated.

3. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

4. Backfill trenches excavated under footings and within 450 mm (18”) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

5. Provide 100 mm (4”) thick, concrete base slab support for piping or conduit less than 762 mm (30”) below surface of roadways, followed by complete enclosure of piping or conduit in a minimum of 100 mm (4”) of concrete after installation and testing and before backfilling or placing roadway sub-base.

6. Place and compact initial backfill of satisfactory soil, free of particles larger than 25 mm (1”) in any dimension, to a height of 305 mm (12”) over the utility pipe or conduit, and as follows:

    1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit.

    2. Coordinate backfilling with utilities testing.

7. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
8. Place and compact final backfill of satisfactory soil to final sub-grade elevation.

3.9. SOIL MOISTURE CONTROL

1. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill soil layer before compaction to within 2% of optimum moisture content, and as follows:
    1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
    2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2% and is too wet to compact to specified dry unit weight.

3.10. COMPACTION OF SOIL BACKFILLS AND FILLS

1. Place backfill and fill soil materials in layers not more than 203 mm (8”) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4”) in loose depth for material compacted by hand operated tampers.
2. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
3. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
    1. Under structures, building slabs, steps, and pavements, scarify and recompact top 305 mm (12”) of existing subgrade and each layer of backfill or fill soil material at 100%.
    2. Under walkways, scarify and recompact top 150 mm (6”) below subgrade and compact each layer of backfill or fill soil material at 100%.
    3. Under lawn or unpaved areas, scarify and recompact top 150 mm (6”) below subgrade and compact each layer of backfill or fill soil material at 95%.
    4. For utility trenches, compact each layer of initial and final backfill soil material at 98%.

3.11. GRADING

1. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated, and as follows:
    1. Provide a smooth transition between adjacent existing grades and new grades.
    2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
2. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrade to required elevations within the following tolerances:
    1. Lawn or Unpaved Areas: ±25 mm (1”)
    2. Walks: ±25 mm (1”)
    3. Pavements: ±13 mm (½”)

3. Grading inside Building Lines: Finish subgrade to a tolerance of 13 mm (½") when measured against a 3050 mm (10'0") straightedge.

3.12. DISPOSAL OF SURPLUS AND WASTE MATERIALS

1. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Departmental Representative's property.

3.13. RESTORATION AND CLEAN UP

1. Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects noted by Departmental Representative.
2. Replace topsoil as indicated.
3. Reinstate pavement, sidewalks, and landscaping to condition and elevation that existed before excavation.
4. Clean and reinstate areas affected by work as directed by Departmental Representative.

END OF SECTION

Appendix B

Standard CMS Translations Rev 2 - July 2018

	English Version	French Version
1	CONST AHEAD	ATT! TRAVAUX
2	CONST AHEAD SLOW	ATT! TRAVAUX RALENTIR
3	EXPECT DELAYS # # MIN	CIRC. AU RALENTI # # MIN
4	CHANGED TRAFFIC PATTERN	SCHÉMA DE CIRC. MODIFIÉ
5	DETOUR AHEAD	ATT! CIRC. DÉVIÉE
6	TRAFFIC LIGHTS AHEAD	ATT! FEUX DE CIRC.
7	CONST FOR NEXT # # KM	TRAVAUX SUR # # KM
8	PREPARE TO STOP	PRÉPAREZ VOUS À ARRÊTER
9	PLEASE OBEY ALL SIGNS	OBÉISSEZ AUX PANNEAUX
10	END CONST	FIN DES TRAVAUX
11	BLASTING AHEAD	ATT! TRAVAUX DYNAMIT.
12	WORK ZONE ENDS	FIN DU CHANTIER CONSTR.
13	RESUME SPEED	REPRISE DE VITESSE
14	DRIVE SAFELY	PRUDENCE SUR LES ROUTES

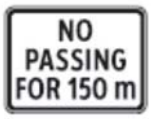
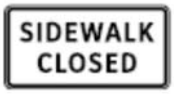
15	ALT ROUTE	AUTRE ROUTE
16	CONST BEGINS MONTH##	DÉBUT TRAVAUX MOIS##
17	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC	JANV FÉVR MARS AVR MAI JUIN JUILL AOÛT SEPT OCT NOV DÉC
18	MON TUE WED THU FRI SAT SUN	LUN MAR MER JEU VEN SAM DIM
19	SMOKE IN AREA	FUMÉE DANS LE SECTEUR
20	DRIVE WITH CAUTION	PRUDENCE SUR LES ROUTES
21	BRIDGE CONST	PONT EN CONST

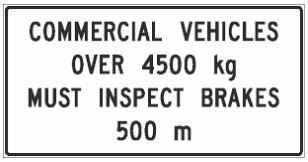
Appendix C

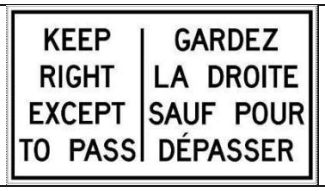
Construction Signage Translation Rev 2 – July 2018

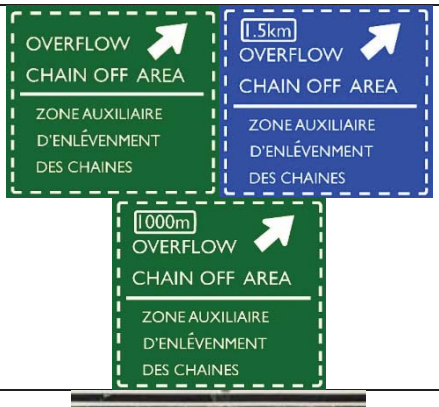
Date: November 25, 2019			
Source	**Sign Reference**	**Construction Sign English**	**Equivalent French Translation**
BC MoTI TMM 2015	C-005-A		DÉVIATION
AT TAWZ	WD-A-10		
BC MoTI TMM 2015	C-018-1A		CONSTRUCTION
AT TAWZ	WD-101		
BC MoTI TMM 2015	C-029		PRÉPAREZ-VOUS À ARRÊTER
AT TAWZ	WD-111		
BC MoTI TMM 2015	C-030-8		CIRC. SUR UNE SEULE VOIE
AT TAWZ	WD-106		
BC MoTI TMM 2015	C-031		VÉHICULES EN SENS INVERSE
BC MoTI TMM 2015	C-032		RALENTIR
BC MoTI TMM 2015	C-033		<u>DYNAMITAGE</u> ÉTEINDRE ÉMETTEURS RADIO

Date: November 25, 2019			
Source	**Sign Reference**	**Construction Sign English**	**Equivalent French Translation**
BC MoTI TMM 2015	C-034		FIN ZONE DE DYNAMITAGE
BC MoTI TMM 2015	C-045-2A		VÉHICULES LENTS
BC MoTI TMM 2015	C-046		MARQUAGE ABSENT
BC MoTI TMM 2015	C-047-2		MARQUAGE TEMPORAIRE
BC MoTI TMM 2015	C-050-2		OUVRIERS EN AVAL
BC MoTI TMM 2015	C-063		SCHÉMA DE CIRCULATION MODIFIÉ
BC MoTI TMM 2015	C-067-T		À XXX M
BC MoTI TMM 2015	C-069		BARRIÈRE ENLEVÉE
BC MoTI TMM 2015	C-080-T		CONSTRUCTION RALENTIR

Date: November 25, 2019			
Source	**Sign Reference**	**Construction Sign English**	**Equivalent French Translation**
AT TAWZ	WD-154		FIN ZONE DE CONSTRUCTION
BC MoTI TMM 2015	C-135-Ta		UNE SEULE VOIE
BC MoTI TMM 2015	C-172-T		INTERDIT DE DÉPASSER SUR 150 M
BC MoTI TMM 2015	C-185-1Ta		BRÛLAGE DIRIGÉ
BC MoTI TMM 2015	C-202		TROTTOIR FERMÉ
BC MoTI TMM 2015	C-203-L/R		TROTTOIR FERMÉ TRAVERSER ICI
BC MoTI TMM 2015	B-C-004-Ta		SUR 2 KM
AT TAWZ	WD-A-41-T		
BC MoTI TMM 2015	B-C-020		RALENTIR
BC MoTI TMM 2015	B-C-020-T		ATTENTION PIÉTONS
BC MoTI TMM 2015	R-001		ARRÊT
BC MoTI TMM 2015	R-012		ROUTE FERMÉE

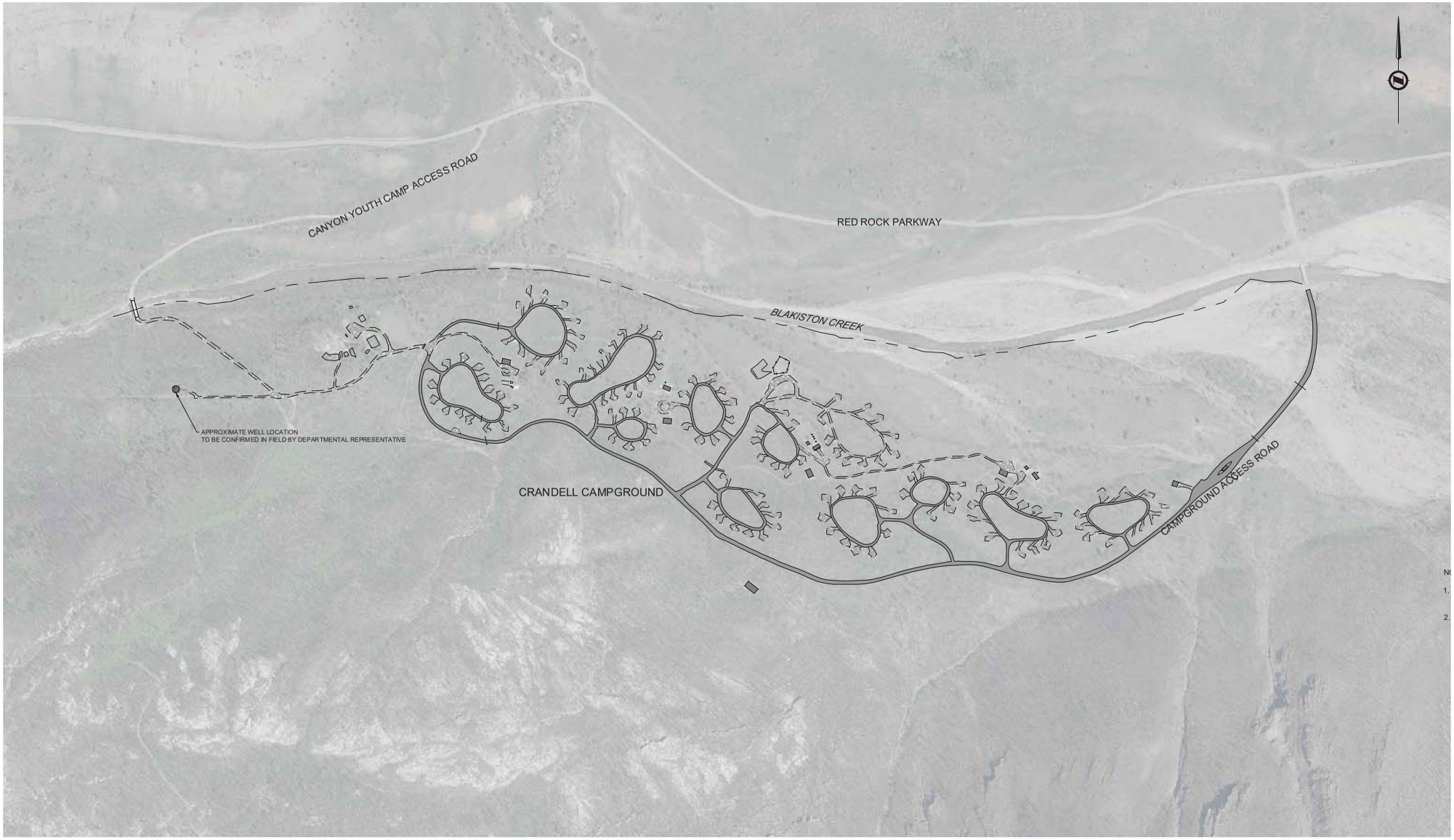
Date: November 25, 2019			
Source	**Sign Reference**	**Construction Sign English**	**Equivalent French Translation**
BC MoTI TMM 2015	R-025-L/R		LIGNE D'ARRÊT
BC MoTI TMM 2015	R-056-1		AUX VÉHICULES EN SENS INVERSE
AT TAWZ 2008	ID-503		AMENDES POUR EXCÈS DE VITESSE DOUBLÉES
AT TAWZ 2008	ID-503A		DÉBUT
AT TAWZ 2008	ID-5038		FIN
AT TAWZ 2008	RB-24		CIRCULATION À DEUX SENS
AT TAWZ 2008	WD-101B		PONT EN CONSTRUCTION
AT TAWZ 2008	RB-216		VÉHICULES COMMERCIAUX DE PLUS DE 4500 KG – VÉRIFICATION DE FREINS OBLIGATOIRE 500 m

Date: November 25, 2019			
Source	**Sign Reference**	**Construction Sign English**	**Equivalent French Translation**
AT TAWZ 2008	RB-217		VÉHICULES COMMERCIAUX DE PLUS DE 4500 KG – VÉRIFICATION DE FREINS OBLIGATOIRE
BC MOTI	R-045		
BC MOTI	R-046		CAMIONS VÉRIFIEZ VOS FREINS ICI PENTE ABRUPTE
BC MOTI	R-009-2		
BC MOTI	R-009-3		MAUVAISE DIRECTION
AT TAWZ	WA-24C-T		
BC MOTI	R-007-2		

Date: November 25, 2019			
Source	**Sign Reference**	**Construction Sign English**	**Equivalent French Translation**
BC MOTI	G-142 (Custom)		*New Shorter Translation:* ZONE AUXILIAIRE DE RETRAIT DES CHAÎNES
N/A	Custom		AVANCEZ ARRÊT DE 20 MINUTES MAXIMUM
BC MOTI	I-104		LE PORT DE LA CEINTURE DE SÉCURITÉ EST OBLIGATOIRE EN COLOMBIE-BRITANNIQUE
BC MOTI	G-011-Tc1-x (Custom) East		
BC MOTI	G-011-Tc1-x (Custom) West		

Appendix D

Water Well Location Sketch



NO
1.
2.

McElhanney

50 0 100
1:2500

Water Well Location

Near existing reservoir

Crandell Campground Reconstruction | SK301

Appendix E

Crandell Mountain Campground Reconstruction Waterton Lakes National Park, Alberta Geotechnical Assessment – December 2019

TECHNICAL MEMO

To	From
Jason Russell, P.Eng, Senior Project Manager Project Delivery Services	Lekan Mitchell, P.Eng., Geotechnical Engineer, McElhanney Ltd.
Company	**Branch**
Parks Canada Agency	2511 - Calgary
Re	**Date**
Crandell Mountain Campground Reconstruction Waterton Lakes National Park, Alberta Geotechnical Assessment	December 12, 2019
	File Number
	2511-01195-00

1. INTRODUCTION

This memorandum presents a summary of the subsurface conditions observed during the field drilling program and geotechnical recommendations for the Crandell Mountain Campground Reconstruction project. McElhanney has prepared this geotechnical assessment in accordance with our proposal, dated June 18, 2019.

McElhanney Ltd. (McElhanney) understands that Crandell Mountain Campground (CMC) is to be modernized and reconstructed after it was destroyed in the Kenow Wildfire of September 2017. This is anticipated to include:

- consolidation and reconfiguration of the campground from a 129 site, 11 loop layout to an approximately 120 site, 5 loop layout;
- construction of a new entrance kiosk including expansion of the paved area around the kiosk;
- construction of a new day visitor parking lot near the entrance kiosk;
- construction of a new RV dump station near the entrance kiosk;
- construction of a new amphitheater;
- construction of new washrooms, kitchen shelters and associated septic systems;
- construction of new winterized privies;
- construction of a new water well, reservoir, treatment shed, and underground distribution network; and
- reconstruction and expansion of the main road and construction of new loop roads and trails around the campground.

The site is located in Waterton Lakes National Park, Alberta along Red Rock Parkway west of Alberta Highway 5. Red Rock Parkway serves as the sole access to the site. Blakiston Creek borders the site to the north, Mount Crandell and Crandell Lake Trail border the site to the south and west, and Mount Blakiston borders the site to the west. CMC is open to campers and day users from Spring to Fall each year with limited unserviced winter camping also available.

This memorandum describes the geotechnical assessment completed for the project and describes the recommended geotechnical design parameters to support the detailed design of the CMC reconstruction.

2. SCOPE OF WORK

The scope of the geotechnical assessment includes:

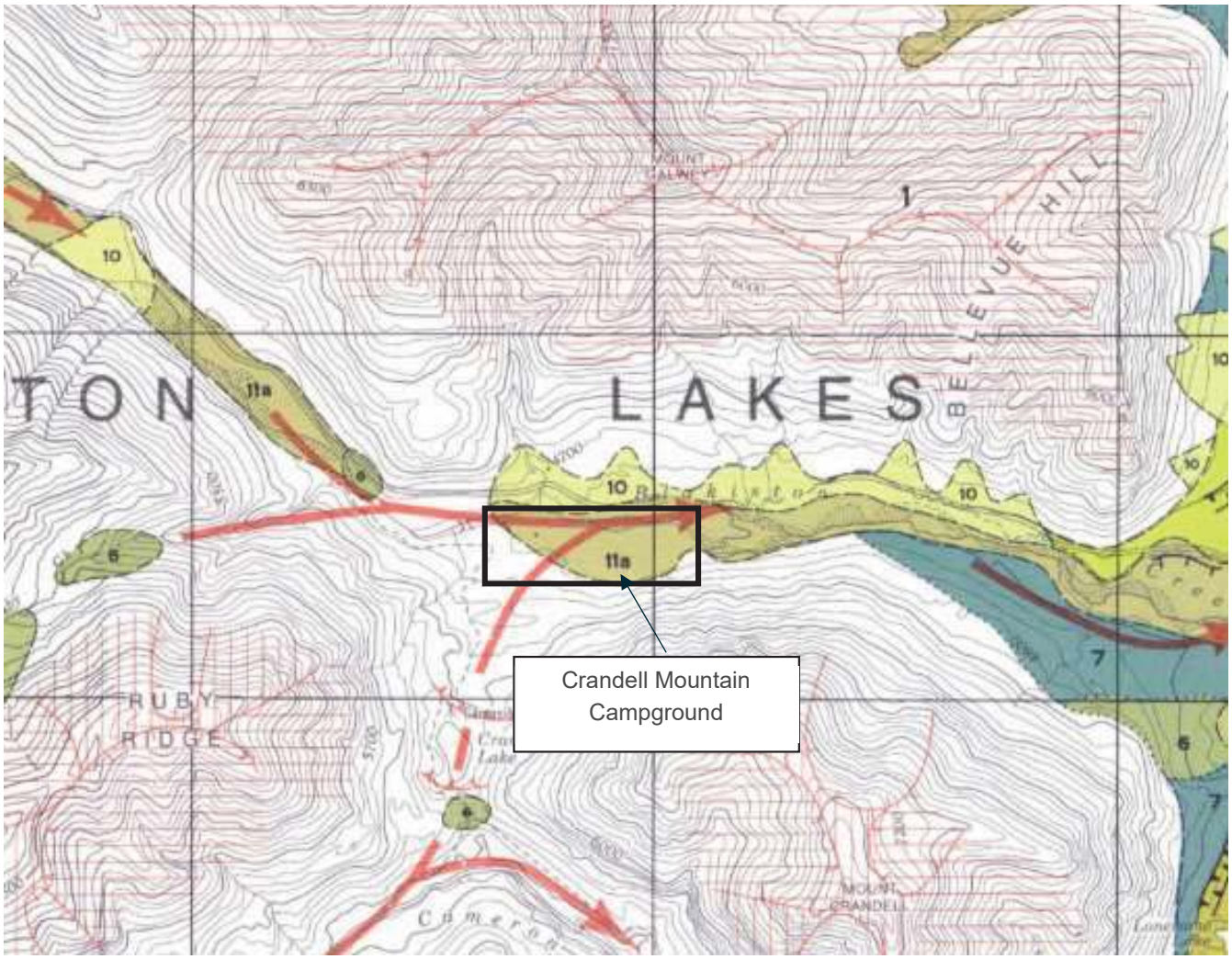
- preparation of a geotechnical assessment plan;
- obtaining Alberta One Call authorization for ground disturbance prior to commencement of the subsurface testing;
- completion of utility locates onsite to ensure test hole clearance;
- completion of a geotechnical drilling program which consisted of 10 boreholes within the CMC;
- completion of limited geotechnical laboratory testing on representative samples; and
- Preparation of a summary memorandum providing describing subsurface conditions encountered and geotechnical recommendations for roadway, paved and unpaved trail, building, and utility design.

The purpose of the geotechnical assessment was to evaluate the existing sub-surface ground conditions within the CMC, and in conjunction with McElhanney's civil design services provide recommendations for the detailed design of building foundations and water tanks, utility layout and construction, and paving gradation and material thickness for roads and trails prior to tendering of the reconstruction work.

3. BACKGROUND GEOLOGICAL REVIEW

The site is located on the floodplain of the Blakiston Valley which meanders along the base of Mount Crandell, Mount Galwey, and Ruby Range as shown below in Figure 1. The Blakiston Valley is a glacial valley that was formed during the retreat of the Waterton-Blakiston glacier when the glacier split and opened up their respectful valleys (Harrison, 1972). It is theorized that during deglaciation in this area, meltwater streams may have deposited over 15 m of sand and gravel along the valley floor (Harrison, 1972). The surficial materials at the site are characterized as coarse stream alluvium; material deposited by modern streams in their flood plains, (Harrison, 1972), and our observations during the drilling investigation are consistent with this characterization.

Figure 1: Excerpt from Geological Survey of Canada Map 1422A (Harrison, 1972) Showing Site Location with Surficial Geology Mapping



4. FIELD ASSESSMENT AND LABORATORY TESTING

McElhanney conducted a geotechnical drilling program within the CMC from August 7 to 9, 2019. The boreholes were drilled by Core Drilling Corporation of Calgary, Alberta to complete the work using a track mounted hollow stem auger drill rig and a track mounted ODEX drill rig. McElhanney staff, Messers. Jeff Brown, E.P. and Mitch Van Orman, E.I.T. of McElhanney, supervised the work on-site. The drilling program consisted of advancing 10 boreholes as shown in Table 1 below and on the map in Appendix A. Testhole BH19-01 was drilled with the track mounted hollow stem auger to 1.6 metres below ground surface (mbgs) before encountering near surface cobbles that resulted in refusal of the auger. Test holes BH19-02 though BH19-10 were drilled with a track mounted ODEX drill to depths from 4.5 mbgs to 6.0 mbgs. The test holes were generally located within the proposed reconstruction footprint and near the proposed locations of the new campground facilities.

McElhanney observed and recorded subsurface conditions in each borehole and collected representative grab samples for laboratory testing. McElhanney conducted standard penetration testing (SPT) in each borehole as the drill advanced.

Each borehole was backfilled with drill cuttings after completion. Borehole logs including SPT-N results are provided in Appendix B.

Table 1: Sample of Boreholes

BOREHOLE ID	COMPLETION DEPTH (mbgs[1])	ELEVATION (masl[2])	EASTING (m)	NORTHING (m)
BH19-01	1.6	1374.42	284995.82	5442674.40
BH19-02	6.0	1377.94	284766.51	5442605.85
BH19-03	4.5	1386.89	284251.13	5442664.15
BH19-04	4.5	1383.56	284323.37	5442781.43
BH19-05	4.5	1387.70	284165.65	5442828.36
BH19-06	4.5	1390.37	284087.31	5442795.81
BH19-07	4.5	1381.52	284469.84	5442632.15
BH19-08	4.5	1383.45	284374.68	5442688.12
BH19-09	4.5	1380.95	284542.08	5442672.54
BH19-10	4.5	1379.19	284654.53	5442538.29

Notes: [1]metres below ground surface
[2]metres above sea level

4.1. Subsurface Conditions

In general, the soils encountered during field excavation program consisted of sand, sand and gravel, and gravel. It is also likely that cobbles and boulders are present across the site from near surface to at least 4.5 mbgs. A surficial layer of topsoil and deleterious fill was encountered in 7 of the 10 boreholes. A summary of subsurface soils is provided below in Table 2.

Table 2: Summary of Subsurface Observations

BOREHOLE ID	COMPLETION DEPTH (mbgs[1])	TOPSOIL / DELETERIOUS FILL (mbgs)	SAND (mbgs)	SAND AND GRAVEL (mbgs)	GRAVEL (mbgs)	GROUND WATER (mbgs)
BH19-01	1.6	–	0 – 0.75	0.75 – 1.5	–	–
BH19-02	6.0	–	4.5 – 6.0	0 – 3.0; 3.2 – 4.5	3.0 – 3.2	–
BH19-03	4.5	–	3.0 – 3.2	0 – 1.5	1.5 – 3.0; 3.2 – 4.5	–
BH19-04	4.5	0 – 0.05	–	–	0.05 – 4.5	–
BH19-05	4.5	0 – 0.05	–	0.05 – 1.7	1.7 – 4.5	–
BH19-06	4.5	0 – 0.05	–	0.05 – 4.5	–	–
BH19-07	4.5	0 – 0.05	–	0.4 – 4.5	0.05 – 0.4	–
BH19-08	4.5	0 – 0.05	–	1.2 – 4.5	0.05 – 1.2	–
BH19-09	4.5	0 – 0.05	–	0.05 – 0.9	0.9 – 4.5	2.8
BH19-10	4.5	0 – 0.05	–	1.0 – 4.5	0.05 – 1.0	–

Notes: [1]metres below ground surface

Surficial Topsoil/Deleterious Fill

Organic silt with gravel, debris, and wood waste was observed in BH19-04 to BH19-10 from surface to 0.05 mbgs. These boreholes are located within the campground loops and near the main spline road.

Sand

Sand was observed in boreholes BH19-01 near the proposed entrance kiosk, BH19-02 between proposed campsite loops C and D, and BH19-03 at the north side of proposed campsite loop C. The sand was generally observed to be dry and loose. The drill encountered refusal at 1.5 m before reaching the bottom of this layer. Additional drilling is required to confirm the thickness of this layer. The sand was observed to exhibit weak cementation in BH19-01 and -02.

Sand and Gravel

A mixture of varying amounts of sand and gravel was observed in each borehole, except BH19-04 on the north side of the proposed loop E. This differentiation presented in the borehole logs is intended to highlight the lower shear strength and higher probability of frost action of sand and gravel when compared to gravel and sand. In support of a conservative analysis we only consider the physical properties of sand and gravel wherever “sand and gravel” is mentioned in this memorandum.

The sand and gravel was observed to be dry and loose to moist and dense. The sand and gravel was observed to exhibit weak cementation in BH19-02 between proposed campsite loops C and D. This suggests that the sand and gravel may be prone to brittle collapse if steep excavation walls are cut into the material.

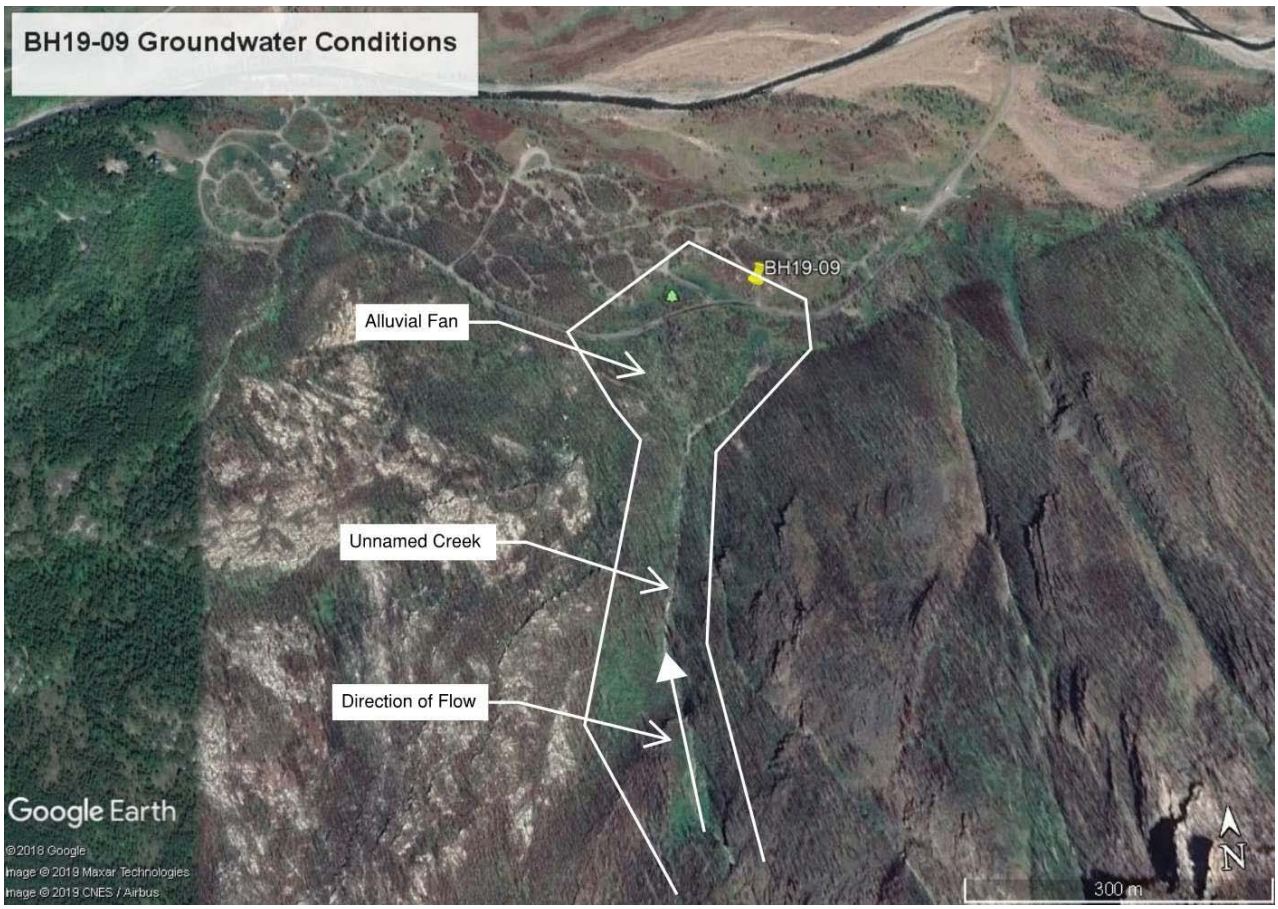
Gravel

Gravel was observed in each borehole except boreholes BH19-01 near the proposed entrance kiosk and BH19-06 between proposed campground loops B and C. The gravel was observed to be sandy and typically ranged from dry and loose to saturated and compact. The gravel was observed to exhibit weak cementation in BH19-02 between proposed campsite loops C and D. This suggests that the gravel may be prone to brittle collapse if steep excavation walls are cut into the material.

4.2. Groundwater

Groundwater seepage was observed in borehole TH19-09 at 2.8 mbgs. Red staining was observed in samples collected from this borehole from about 0.9 mbgs to 4.5 mbgs. This may be an indication of oxidation, which suggests that there may be seasonal groundwater fluctuations in this area. Borehole BH19-09 appears to be located at the toe of an alluvial fan at the mouth of an unnamed creek flowing down Mount Crandell as shown in Figure 2. Although no surface runoff was observed near BH19-09 during the field assessment work, it is likely that the groundwater encountered in this borehole is related to the base flow from the unnamed creek on Mount Crandell. No groundwater was observed in the other 9 boreholes during the field assessment.

Figure 2: Crandell Mountain Campground (Google Maps, 2019) Showing Location of Borehole BH19-09 in Relation to Approximate Limits of Unnamed Creek and Alluvial Fan on Mount Crandell



4.3. Laboratory Testing

Selected soil samples were transported to Artech Consulting Ltd. in Cranbrook, BC for index testing including moisture content and grain size analysis. A summary of the laboratory test results is provided below in Table 3 and detailed results are provided in Appendix C. The soils encountered were classified in accordance with the Modified Unified Classification System for Soils included in Appendix B.

Table 3: Summary of Laboratory Testing

BOREHOLE ID	SAMPLE DEPTH (M)	MOISTURE CONTENT (%)	SOIL CLASSIFICATION	GRADATION (%)		
				GRAVEL	SAND	FINES (SILT/CLAY)
BH19-01	1.1	5.1	GW-SW	60	35	5
BH19-02	1.5 – 3.0	1.0	GW-SW	58	40	2
BH19-03	0 – 1.5	3.3	GW-GM/GC	51	43	6
BH19-04	1.5 – 3.0	2.6	GW	67	30	3
BH19-05	0 – 1.5	4.8	SP-SM/SC	40	51	9
BH19-06	0 – 1.5	2.6	SW-GW	38	58	4
BH19-07	1.5 – 3.0	1.6	SW-GW	48	49	3
BH19-08	3.0 – 4.5	2.1	GW-SW	56	41	3
BH19-09	0 – 1.5	1.9	SW-GW	46	50	4
BH19-10	1.5 – 3.0	2.5	SW-SM/SC	44	51	5

5. DISCUSSION AND RECOMMENDATIONS

The preliminary geotechnical recommendations provided in this memorandum are based on a limited geotechnical investigation and the proposed CMC reconstruction option A as shown in Appendix A. Subsurface conditions across the site may vary from this report where a particular location was not tested or a tested location was subsequently disturbed prior to construction. Any unsuitable materials encountered in areas not assessed by McElhanney should be confirmed during site preparation activities.

The following sections provide geotechnical recommendations for design and construction of pavements for roads and trails, gravel paths for trails, foundations for small buildings and structures, site utility lines, and septic field design. The recommendations in this report should be read in conjunction, unless otherwise noted, with the most current Parks Canada best practices and design guides and with the sealed detailed design drawings prepared McElhanney.

5.1. Site Suitability

McElhanney expects that the subgrade across the CMC will be comprised of sandy, silty, granular soils that range in compaction from loose to dense. Loose, soft, frozen, or organic subgrade soils are not considered suitable for the proposed construction and must be addressed as described in the following sections. Note that the subsurface conditions may change in locations not explicitly investigated and/or may vary due to activities carried out at the Site following the

field assessment. The thickness of unsuitable materials in areas not assessed by McElhanney should be confirmed during site preparation activities.

5.2. Excavations

Temporary excavations of up to approximately 4 m deep are expected to facilitate the construction of underground utilities, foundations, and buried tanks. All excavations shall be completed in accordance with the current revision of the Alberta Occupational Health and Safety Code. Slope stability analysis was not conducted as part of this assessment. However, weak cementation observed in the sands at the site suggests that the sands may be prone to brittle collapse if steep excavation walls are cut into the material. Given the potential for collapse of steep excavation walls at the CMC due to weak cementation, cut slopes shall be no steeper than 2H:1V. Water should not be allowed to enter excavations and all excavations should be regularly checked for signs of instability throughout each day that the excavation remains open and after periods of rain. No surcharge loading such as stockpiles, vehicles, or heavy equipment should be allowed from the top edge of the excavation within a horizontal offset equal to the depth of excavation or 1.5 m, whichever is greater. If site conditions are different than what was observed during this drilling program or if instabilities are noted, then a Geotechnical Engineer should be engaged to provide temporary slope recommendations.

5.3. Site Preparation

Stripping of organic soils and sub-excavation of loose/soft subgrade soils will be required within the footprint of the proposed infrastructure. The following recommendations are provided:

1. To facilitate construction of the new roads, trails, and structures, a minimum of 50 mm of sub-excavation into the existing ground within the construction footprint will be required to remove organic soils. If loose, soft, or wet soil or fill is encountered at or immediately below subgrade elevation then a geotechnical engineer must be engaged to advise on remedial action. Such action could include, but is not limited to, replacement of the undesirable soil or fill, reinforcement of the undesirable soil or fill, or redesign of the asset.

2. All stripped and/or sub excavated subgrades should be reviewed in the field by the Geotechnical Engineer or their representative to confirm that loose/soft, wet, weakened and organic soils, and/or fills have been appropriately removed prior to further construction. Proof-rolling with a 10-tonne steel drum compactor or other approved proof rolling equipment will be necessary.

3. Subject to field review at the time of construction, all sub-excavated areas should be backfilled with Engineered Fill as approved by the Geotechnical Engineer.

4. Within 2 m of all structures, the finished subgrade should be sloped a minimum of 5% away from the structures to promote drainage.

5. Finished subgrade for all paved roads and trails should be constructed with a cross fall of 2% to promote drainage.

6. Finished subgrade for all unpaved trails should be constructed with a cross fall of 3% to promote drainage.

7. Finished subgrade for all paved parking lots should be sloped a minimum of 3% away from the lot to a well drained area.

5.4. Engineered Fill

Any fill soil placed to support structural elements of the development shall be considered Engineered Fill. Recommendations for material quality and placement of Engineered Fill are summarized as follows:

1. Engineered Fill for pavements and constructing additional grade beneath structures should meet the requirements of Alberta Transportation (AT) Des 6 Class 80 aggregate.

2. Engineered Fill for pipelines and backfill adjacent to foundation walls should meet the requirements of AT Des 2 Class 25 aggregate.

3. Engineered Fill should be placed on subgrade prepared as recommended in Section 5.3.

4. Engineered Fill used to support load bearing structures, utilities, or any other components that may be settlement sensitive should be compacted to a minimum of 100% Standard Proctor Maximum Dry Density (SPMDD) according to the most recent version of ASTM D698, unless otherwise requested by the Geotechnical Engineer.

5. In landscaped areas or other areas where the risk of differential and/or total settlement greater than 25 mm may be acceptable, Engineered Fill may be compacted to a minimum of 95% SPMDD.

6. Engineered Fill should be placed in horizontal lifts to a maximum loose thickness of 300 mm depending on the compaction equipment utilized and should be placed at moisture conditions within 3% of the optimum moisture content as determined by a Standard Proctor Moisture-Density Test (ASTM D698).

7. Within 2 m of all structures, the Engineered Fill should be sloped a minimum of 5% away from the structures to promote drainage.

8. Continuous Quality Control compaction testing and quality assurance construction reviews should be performed by the Geotechnical Engineer's representative or a qualified testing agency during placement of all Engineered Fill to verify compliance with the above recommendations.

In discussions with PCA after conducting our field investigation, PCA requested that McElhanney consider the feasibility of reusing site materials as Engineered Fill. It is possible for the Contractor to use screening and crushing plants to produce Engineered Fill from wasted excavation material, granted that the wasted excavation material is free from frozen or organic material. However, additional field investigation is required to estimate the Engineered Fill recovery rate if produced from waste excavation. If the actual Des 6 Class 80 recovery rate is 50% then the Contractor should be able to produce enough of that material to fulfill the needs of the project. If the actual Des 2 Class 25 recovery rate is 15% then the Contractor will not be able to produce enough of that material to fulfill the needs of the project.

5.5. Pavements

General

PCA requested that all pavement structures have a design life of a minimum of 30 years with no surface rutting based on a defined maximum vehicle loading. They requested that the pavement structure be durable, robust, and to a minimum standard required by PCA or Transportation Association of Canada (TAC). In further discussions with PCA after conducting our field investigation, PCA requested that McElhanney consider the following additional scenarios:

- pavement structure meeting AT standards for comparison with the high performance 30-year pavement; and
- pavement structure that is inset into the original ground.

To facilitate pavement design McElhanney estimated the traffic volumes through the reconstructed campground and grouped pavements based on their anticipated usage and traffic volumes. PCA informed McElhanney that the campground is usually open for 5 to 6 months per year and is usually fully occupied during this time. Therefore, we made the following assumptions when estimating the annual average daily traffic counts (AADT) and design traffic volumes:

- the campground will be fully occupied for 6 months per year;
- traffic growth is not considered as the campground will be fully occupied during its service life; and
- vehicle type distribution is not considered – all traffic is assumed to be comprised of the design vehicle.

The following is a summary of our estimated AADT in terms of vehicles per day (VPD):

- main spline road and parking lot – 270;
- loop roads – 90; and
- paved trails – 2.

In discussions between PCA and McElhanney, it was decided that the design vehicle will be a mid sized recreational vehicle (RV) with a maximum length of 9 m. However, axle loading for this type of vehicle is not regulated in Canada and TAC provides limited guidance on addressing this type of vehicle in pavement design. Therefore, we used an AT) Single Unit Truck as an analogue to the RV. AT defines a single unit truck as a single non-articulating truck greater than 3 tonnes in weight. AT assumes that the weight of this truck is equivalent to 0.881 of an equivalent single axle load (ESAL), or 7,136 kg.

High Performance Pavements and AT Standard Pavements

In support of a robust pavement design, the following operational factors were considered:

- vehicles will be travelling slowly over the pavement and a large volume of start/stop and turning maneuvers are expected;
- although test holes and laboratory testing suggest that subgrade soils consist of a mixture of gravel and sand, local variations in sand content could impact the long-term pavement structure;
- PCA does not usually complete preventative or routine maintenance on its roadway assets so the pavement structure must be able to survive its design life with minimal maintenance;
- it is unlikely that snow will be cleared from the campground roads throughout the winter when the campground is closed; and
- the design life requested by PCA is 10 years longer than the design life used by AT and BC Ministry of Transportation and Infrastructure.

McElhanney recommends the following for detailed pavement designs:

1. The pavement structure for PCA specified pavements and equivalent AT pavements shall be as specified in Tables 4 to 6.

Table 4: Recommended Pavement Structure for Main Spline Road and Parking Lots

Pavement Layer	Minimum Thickness		Geosynthetic Specification	
	PCA	AT	PCA	AT
Asphalt Concrete	120 mm	100	–	–
Granular Base Course	150 mm	290	*Tensar TX 8 or approved equivalent at base of layer	AT Type B Geotextile at base of layer
Granular Sub-Base Course	150 mm	–	AT Type B Geotextile at base of layer	–

Table 5: Recommended Pavement Structure for Loop Roads

Pavement Layer	Minimum Thickness		Geosynthetic Specification	
	PCA	AT	PCA	AT
Asphalt Concrete	110 mm	100	–	–
Granular Base Course	290 mm	215	AT Type B Geotextile at base of layer	AT Type B Geotextile at base of layer

Table 6: Recommended Pavement Structure for Paved Trails

Pavement Layer	Minimum Thickness		Geosynthetic Specification	
	PCA	AT	PCA	AT
Asphalt Concrete	50 mm	50	–	–
Granular Base Course	160 mm	160	AT Type B Geotextile at base of layer	AT Type B Geotextile at base of layer

** Geosynthetic reinforcement has been considered in place of additional granular structure that would be required to support the anticipated vehicle loading.*

2. The asphalt concrete mix shall be as specified below.
   a) main spline road and parking lots:
      I. PCA – AT M1 mix with a PG70-31P or higher low-temperature performance binder;
      II. AT – AT L1 mix with a PG52-34 binder;
   b) loop roads:
      I. PCA – AT L1 mix with a PG70-31P or higher low-temperature performance binder;
      II. AT – AT L1 mic with a PG52-34 binder;
   c) paved trails:
      I. PCA – AT L1 mix with a PG70-31P or higher low-temperature performance binder; and
      II. AT – AT L1 mix with a PG52-34 binder.

3. Granular Base Course should meet AT specifications for a Des 2 Class 25 aggregate.

4. Granular Sub-Base Course should meet AT specifications for a Des 6 Class 80 aggregate.

5. All asphalt and granular materials should be supplied and placed in accordance with AT's Standard Specifications for Highway Construction, Edition 15.

6. Scope, frequency, and locations of asphalt testing shall be at the discretion of the Design Engineer. However, we recommend that AT Specification Amendment AMC_S201 - Amendments to Specification 3.50, Asphalt Concrete Pavement (EPS, Re: Acceptance Testing for Contracts with Small Quantities (less than 1 000 t of Asphalt Concrete Pavement) be used as a guide.

7. Scope, frequency, and locations of granular material testing shall be at the discretion of the Design Engineer. However, we recommend that AT Standard Specification for Highway Construction 3.2 – Aggregate Production and Stockpiling; 3.6 – Granular Base Course; and 3.8 – Granular Fill be used as a guide.

Inset Pavements

McElhanney understands that PCA prefers to construct pavements with surfacing that is at the same grade as the adjacent ground. Inset pavements are common in urban areas where curbs, gutters, and drains provide suitable separation between surface water and the pavement structure. However, in areas where suitable road drainage infrastructure does not exist, a given pavement structure will likely have a shorter service life if inset into adjacent ground.

McElhanney considered the effect of insetting the AT standard pavements proposed for this site and found that:

- the main spline road will reach its terminal service condition in approximately 15 years instead of 20 years; and
- the loop roads will reach their terminal service condition in approximately 12 years instead of 20 years.

To increase the likelihood that the AT standard pavement structure lasts at least 20 years before reaching its terminal service condition, we estimate that the thickness of the pavement granular layers will need to be increased by 10%. However, this must be confirmed by the Geotechnical Engineer during road subgrade preparation. Alternatively, a high-strength geogrid approved by the Geotechnical Engineer could be incorporated into the pavement's granular structure.

Pavement Maintenance

Pavement surfaces will deteriorate and exhibit cracking over time. If left unaddressed, the pavement could deteriorate to an unacceptable level well before its design life. Routine maintenance such as but not limited to crack sealing and snow clearing will assist in extending the life of the pavement structure. We recommend that PCA regularly inspect all pavement structures and develop and implement a pavement maintenance plan to help extend the life of the pavement structure.

5.6. Unpaved Trails

McElhanney understands that unpaved trails may be constructed at the CMC and we have assumed that unpaved trails will not experience vehicle loading. Unpaved trail embankments should be constructed with a minimum thickness of 200 mm of AT Des 6 Class 80 aggregate over an AT Type B geotextile. Surfacing should be a minimum thickness of 150 mm of AT Des 2 Class 25 aggregate. All material should be placed in lifts not exceeding 150 mm and compacted to minimum 98% SPMDD. The surface of each layer should be constructed with a cross fall of 3% to promote drainage of the trail.

5.7. Frost Penetration

The native sand and gravel observed at the site is estimated to have a frost penetration depth of 2.8 m with a low to moderate risk of frost action.

5.8. Buildings and Structures

McElhanney understands that the following new buildings are proposed for the campground reconstruction:

- entrance kiosk;
- concession building;
- utility buildings;
- firewood storage sheds;
- washrooms;
- winter privies;
- kitchen shelters; and
- amphitheatre.

We understand that all buildings will be 1 storey, conventionally constructed buildings with pad and/or strip footings with slab on-grade foundations and no basement. The following recommendations are provided for building construction.

Shallow Foundation Recommendations

Shallow strip and spread footings are considered suitable for the proposed structures, provided that the footings are constructed on engineered fill or compact to dense native granular subgrade. Subgrade preparation must be as described in Section 5.3 of this memorandum and Engineered Fill placement must be as described in Section 5.4 of this memorandum.

Preliminary bearing pressures for strip and square footings are provided in Tables 7 and 8 below. The lower of the bearing capacities presented for each foundation type, subgrade soil, and range of base widths may be assumed for preliminary design. McElhanney should be engaged to review bearing capacities during detailed building design, and at that time can provide specific capacities for requested design scenarios if needed.

Table 7: Summary of Preliminary Factored Bearing Capacity for Strip Footings

Subgrade Soil	Minimum Depth to Embedment (m)	Base Width (m)	Bearing Capacity (kPa)	
			Factored Ultimate Limit State[1] (ULS)	**Serviceability Limit State[2] (SLS)**
Native Sand and Gravel Subgrade	**0.8**	**0.5 to 1.5**	85	85
		1.5 to 3.0	100	90
Engineered Fill[3]	**0.8**	**0.5 to 1.5**	250	250
		1.5 to 3.0	315	225

Notes:

1. Canadian Foundation Engineering Manual, 4th Edition (2006). Canadian Geotechnical Society, Bitech Publishing Ltd., Richmond, BC. The ultimate resistance factor values are based on semi-empirical data and are calculated using a geotechnical resistance factor of 0.5.
2. For settlements of less than 25 mm.
3. Engineered Fill 1.5 m or greater thickness compacted to 100% SPMDD on native sand and gravel material.

Table 8: Summary of Preliminary Factored Bearing Capacity for Square Footings

Subgrade Soil	Minimum Depth of Embedment (m)	Base Width (m)	Bearing Capacity (kPa)	
			Factored Ultimate Limit State[1] (ULS)	**Serviceability Limit State[2] (SLS)**
Native Sand and Gravel Subgrade	**0.8**	**0.5 to 1.5**	85	85
		1.5 to 3.0	90	90
Engineered Fill[3]	**0.8**	**0.5 to 1.5**	225	225
		1.5 to 3.0	255	225

Notes:

1. Canadian Foundation Engineering Manual, 4th Edition (2006). Canadian Geotechnical Society, Bitech Publishing Ltd., Richmond, BC. The ultimate resistance factor values are based on semi-empirical data and are calculated using a geotechnical resistance factor of 0.5.
2. For settlements of less than 25 mm.

3. Engineered Fill 1.5 m or greater thickness compacted to 100% SPMDD on native sand and gravel material.

The following recommendations are provided for shallow strip and spread footings:

1. Footings for the proposed structures must be founded on approved, undisturbed, unfrozen, inorganic soil or crushed aggregate.

2. Soils beneath the footing must not be allowed to freeze during or after construction. The footing subgrade must be protected from freezing during and after construction.

3. Additional reinforcing steel should be placed in the strip footing at the crossing location of any planned utility (water/sewer) service trench. We recommend that 5-15M reinforcing bars extending 1m beyond the edge of trench each way be placed at such locations.

4. We recommend that the excavation and building siting be reviewed by a qualified geotechnical engineer prior to foundation placement.

5. Seepage or surface water runoff must not be allowed to enter foundation excavations. Any water or snow that collects in the footing excavation must be removed and subgrade soils must be allowed to dry prior to construction of the footings.

6. Concrete footings should be protected from freezing and proper curing conditions should be provided as per Canadian Standard Association (CSA) concrete specifications.

7. Footings founded above frost depth and foundation walls must be protected using insulation as outlined in this memorandum.

8. We understand that the buildings will not contain a basement or crawlspace. If this changes and a portion of the structure will be set below grade, then we recommend a drain tile or pipe and granular drainage aggregate (groundwater collection) system be installed along the base of the footings outside the building footprint, and have the water discharge down below the building. The system should, at a minimum meet the Alberta Building Code Section 9.14 requirements. We further recommend that:
   a) drain pipe or tile is placed approx. 0-100 mm below footing grade, and preferably directly on top of geotextile fabric;
   b) drain pipe or tile be placed along the perimeter of the structure and connect to a header pipe along the edge;
   c) drain pipe have perforations at 4 and 8 o'clock;
   d) drain pipe should slope at minimum 1%, drain to a solid collector pipe, and discharge to a frost-free outfall downslope of the structure;
   e) granular drainage aggregate is extended a min. 300 mm over the pipe and geotextile is wrapped over the granular drainage aggregate on the exterior of the foundation back to the wall before backfilling; and
   f) drain pipe should be PVC SDR 28 or 35 pipe.

Foundation Wall Recommendations

The following recommendations are provided for foundation walls:

1. Foundation wall backfill should be compacted to a minimum of 100% SPMDD, unless identified differently by the geotechnical engineer inspecting the construction work.

2. The placement and compaction of wall backfill should be completed simultaneously on the inside and outside of the walls. For foundation wall backfill above slab-on-grade the main floor system should be installed prior to exterior backfill.

3. Final grades along the external foundation wall should be designed with a gradient of at least 5% over 1.5 m to direct water away from the building.

4. For any foundation walls above slab elevation that are backfilled with the native soils, we recommend that two layers of emulsified asphalt waterproofing product be applied with a drainboard (Delta MS or approved equivalent) as a minimum.

5. Engineered Fill should be used as backfill around foundation walls.

Grade Supported Floor Slab Recommendations

Subgrades should be prepared as recommended in Section 5.3 with any unsuitable subgrade material being removed and replaced with Engineered Fill due to the risk of differential settlement of any loose, deleterious or compressible materials.

The design of grade supported floor slabs is typically governed by the stiffness and settlement characteristics of the slab, not the overall bearing capacity. The modulus of vertical subgrade reaction is typically used to represent the vertical stiffness of the soil below the foundation. It is not a fundamental property of the soil and its value varies based on foundation size. the theory of subgrade reaction assumes that the soil behaves in a linear manner under static loading.

McElhanney has estimated the unsubmerged modulus of vertical subgrade reaction for a standard 300 mm x 300 mm square plate area as follows:

- native sand and gravel – 20 MPa/m; and
- engineered fill – 60 MPa/m.

The Design Engineer may use the following relationship to estimate the modulus of subgrade reaction for an on-grade slab:

$$k_{vb} = k_{v1} [(3.28b + 1) / 6.56b]^2$$

Where:

- k_{vb} – modulus of vertical subgrade reaction (MPa/m) for the actual foundation with dimension “b”;
- k_{v1} – modulus of vertical subgrade reaction (MPa/m) for the standard 300 mm x 300 mm square plate; and
- b – foundation width (metres).

The following recommendations are provided for grade supported floor slabs:

1. A minimum of 300 mm thick AT Des 2 Class 25 aggregate compacted to 100% of SPMDD should be placed below the underside of the floor slab before concrete placement.

2. Where additional grade is necessary, we recommend that embankments be constructed with Engineered Fill compacted to 100% SPMDD in lifts not exceeding 150 mm.

3. If there are backfilled foundation walls above a sub slab or crawlspace elevation, we recommend that a minimum 6 mm thick polyethylene heavy-duty vapour barrier should be installed on the underside of the building floor slab

with sealed joints and be sealed back to the foundation wall. Any penetrations through the vapour barrier (plumbing, etc) must be sealed and waterproofed.

4. Separation joints should be used to isolate the slab from foundation walls, columns, and other structural foundation components.

5. The adjacent finished grade should be designed with a gradient of at least 5% over a horizontal distance of 1.5 m to direct surface water from the building.

The following recommendations are provided for unheated grade supported floor slabs assuming that they are constructed on native sand and gravel:

1. A minimum of 300 mm thick AT Des 2 Class 25 aggregate compacted to minimum 98% SPMDD should be placed below the underside of the floor slab before concrete placement.

2. If the above options are not feasible, a structural slab should be considered.

Sulphate Exposure – Concrete Requirements

Laboratory testing for water-soluble sulphate in soils was not conducted as the coarse-grained alluvial soils at this site are expected to contain water-soluble sulphate concentrations below the “Moderate” degree of exposure as defined in CSA A23.1-14, Table 3 (CSA 2018). Concrete meeting the following exposure types are expected to be suitable for use on this project:

- C-1;
- C-XL; and
- S-3.

Frost Protection for Structures

Subsurface conditions observed at the CMC suggest that subgrade materials may be low to moderately frost susceptible. If frost is permitted to penetrate then there is a risk of frost action on the concrete slab or footings. Concrete foundations must not be placed on frozen soils and soils beneath the foundation should not be allowed to freeze during or after construction. Concrete foundations should be protected from freezing, and proper curing conditions should be provided as per Canadian Standard Association (CSA) concrete specification A23.1-14. Footings founded above the frost depth must be protected using insulation.

To reduce the potential for frost heaving, foundations should be buried with a minimum cover of 2.8 m. If the recommended minimum foundation soil cover cannot be achieved, then thermal insulation for foundation frost protection should be considered. If heated structures are proposed, additional recommendations can be provided.

The following recommendations are provided for thermal insulation for foundation frost protection:

1. Unheated shallow foundations located within the frost zone must be protected with a 100 mm thick layer of Styrofoam Highload-40 insulation or equivalent placed on a bedding of AT Des 2 Class 25 aggregate immediately beneath the entire area of the interior floor and shall extend a minimum of 2.5 m from the exterior walls of the structure. Sections of the insulation extending away from the exterior walls should have a minimum soil cover of 300 mm.

2. All foundation walls must be protected from frost action with Styrofoam Highload-40 insulation or equivalent placed along the foundation wall from the base of the foundation wall to 300 mm above finished grade. The unheated foundation walls proposed at the site must be protected with a 100 mm thick layer of insulation.

3. Where insulation placement conflicts with buried building systems such as radon collection systems, insulation should be placed between the buried building system and the foundation.

4. The insulation should be designed with a gradient of at least 2% to direct surface water away from the building.

5.9. Utilities

McElhanney understands that a new water and wastewater system will be installed as part of this project. We understand that the system will include:

- above-ground freshwater storage and treatment facility;
- buried freshwater and septic main and service pipes;
- buried RV dump station tanks; and
- septic fields.

Above-ground Freshwater Storage and Treatment Facility

The above-ground freshwater storage and treatment facility should be designed and constructed in accordance with the applicable recommendations provided in Section 5.8 of this memorandum.

Buried Freshwater and Septic Pipes

The following recommendations are provided for the design and construction of buried freshwater and septic pipes:

1. It is possible that loose, soft, wet, organic or otherwise unsuitable material may be encountered during trenching. When unsuitable material is encountered at the base of the trench, it should be sub-excavated to expose a firm base and the sub-excavated material should be replaced with AT Des 2 Class 25 aggregate. Where sub-excavation to a firm base is not feasible then McElhanney should be engaged to provide location specific recommendations.

2. Pipe bedding should be compatible with the size, type, class of pipe, and the requirements of the pipe manufacturer. In the absence of special provisions and specifications, it is recommended for preliminary design that a minimum of 150 mm of bedding material be placed below the pipe and 300 mm of bedding material be placed above the pipe. AT Des 2 Class 25 aggregate compacted to 100% SPMDD is suitable for use as pipe bedding material.

3. The native sand and gravel may be used for trench backfill provided that it is free of cobbles or boulders larger than 75 mm in diameter, organic, clayey, or deleterious material, and it can be moisture conditioned to within 2% of its optimum moisture content and compacted to within 2% of its optimum moisture content. Trench backfill should be placed in lifts not exceeding 300 mm in loose thickness and should be compacted to 100% SPMDD.

4. The composition of the trench backfill should be uniform along the entire length of the trench. Only one type of backfill material should be used, and the material should be mixed prior to placement to ensure uniformity.

5. The native sand and gravel at the site is considered to have a high rate of frost penetration with a low likelihood of frost action. To reduce the risk of freezing in the pipelines, we recommend that a minimum of 2.8 m of cover

be placed over the pipelines. Pipelines buried with less than the minimum recommended soil cover should be protected with Styrofoam Highload-60 insulation or equivalent.

a) The Design Engineer may estimate the minimum width of insulation required using the following formula:

$$W = D+2(F-X)$$

Where: W = Total insulation width (m);

D = Pipe diameter (m);

F = Design frost depth of 2.8 m; and

X = Depth to top of the pipe (m).

b) The design engineer may estimate the minimum thickness of insulation required based on Table 10 below.

Table 10: Recommended Insulation Thickness for Buried Pipes

AMOUNT OF BACKFILL OVER THE INSULATION (m)	MINIMUM THICKNESS OF INSULATION (mm)
0.6	75
0.9	65
1.2	50
1.5	40
1.8	25
2.5	25

6. If the groundwater table is located above the crown of the pipeline and the pipeline is not full then the pipeline will be subjected to a buoyant force that may cause the pipeline to float to the ground surface. Based on limited site data, buoyant forces are expected below 2.8 mbgs south of and within 20 m north of the campground's main access road. To mitigate buoyancy effects, the buoyant force must be less than the resisting force of the material above the pipeline.

a) The buoyant force of can be calculated using the following formula:

$$F = Vol_{pipe} \times Y_f \times g$$

Where: F = Buoyant Force (kN);

Vol_{pipe} = Volume of the pipe (m^3);

Y_f = Density of Water (kg/m^3); and

g = Force of gravity (9.81 m/s^2);

Buried RV Dump Station Tanks

McElhanney understands that the buried RV dump station tanks will likely be located near the entrance kiosk. Limited geotechnical data is available at this location and it is recommended that a drilling investigation be conducted at the tank locations prior to tank installation. The following recommendations are provided for preliminary design:

1. An 8-foot diameter, 40 m^3 capacity double walled “ZCS Xerxes” brand fiberglass tank was selected as the design tank to estimate the foundation bearing capacity. The serviceability limit state bearing capacity of the foundation materials for a maximum settlement of 25 mm at a foundation depth of 4 mbgs is estimated to be 45 kPa. McElhanney should be engaged to review bearing capacities when the final tank design is completed, and more geotechnical data is collected.

2. Bedding and backfill for the buried RV dump station tanks should be in accordance with the tank supplier recommendations.

3. It is likely that the RV dump station tanks will be subjected to buoyancy forces that cannot be overcome by the weight of the backfill material. We recommend that the dump station tanks be designed with a buoyancy control system.

4. Deep excavations will be required to install the RV dump station tanks. Excavations should be constructed as described in Section 5.2 of this memorandum.

5. It is likely that the buried RV dump station tanks will be founded below the frost penetration zone and not subject to frost action. No insulation is recommended. In the event that the tanks are founded within the frost penetration zone, McElhanney should be engaged to provide frost protection recommendations.

Buried Septic Fields

At the time of this memorandum, it is understood that a desired septic system configuration has not been selected. Recommendations for septic system design and construction will be provided in a report prepared by the septic system consultant, Osprey Engineering Ltd. as sub-consultants to McElhanney.

6. DESIGN AND CONSTRUCTION REVIEW

Once detailed site development and foundation designs have been prepared, it is recommended that the design be reviewed by the Geotechnical Engineer to verify that all geotechnical recommendations have been included in the final design. During construction, it is recommended that the Geotechnical Engineer be engaged to conduct field reviews of native and imported materials, subgrade conditions, and foundation frost protection measures.

7. CLOSURE

This memorandum has been prepared by McElhanney Ltd. for Parks Canada Agency. The information and data contained herein represent McElhanney's best professional judgment considering the knowledge and information available to McElhanney at the time of preparation. Except as required by law, this memorandum and the information and data contained herein are to be treated as confidential and may be used and relied upon only by the client, its officers, and employees.

McElhanney Ltd. denies any liability whatsoever to other parties who may obtain access to this memorandum for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this document or any of its contents without the express written consent of McElhanney and Parks Canada Agency. This memorandum is subject to the attached Statement of Limitations – Geotechnical Services.

We trust this memorandum submission meets your requirements for the project. Should you have any queries, please do not hesitate to contact the undersigned.

Respectfully submitted,

McElhanney Ltd.

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APEGA Permit to Practice: P6383

8. REFERENCES

Harrison, J E. (1976). Miscellaneous Report 26. Geological Survey of Canada. Retrieved from https://doi.org/10.4095/104936.

Canadian Standards Association. (2014). A23.1-14, Concrete Materials and Methods of Concrete Production. (2018 Reprint).

Canadian Geotechnical Society. (2006). Canadian Foundation Engineering Manual. (4th edition).

Statement of Limitations – Geotechnical Services

Use of this Report. This report was prepared by McElhanney Ltd. ("**McElhanney**") for the particular site, design objective, development and purpose (the "**Project**") described in this report and for the exclusive use of the client identified in this report (the "**Client**"). The data, interpretations, and recommendations pertain to the Project and are not applicable to any other project or site location, and this report may not be reproduced, used or relied upon, in whole or in part, by a party other than the Client, without the prior written consent of McElhanney. The Client may provide copies of this report to its affiliates, contractors, subcontractors and regulatory authorities for use in relation to and in connection with the Project provided that any reliance, unauthorized use, and/or decisions made based on the information contained within this report are at the sole risk of such parties. McElhanney will not be responsible for the use of this report on projects other than the Project, where this report or the contents hereof have been modified without McElhanney's consent, to the extent that the content is in the nature of an opinion, and if the report is preliminary or draft. This is a technical report and is not a legal representation or interpretation of laws, rules, regulations, or policies of governmental agencies. The professional services retained for this Project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in this report. In particular, environmental conditions such as surface and subsurface contamination are outside the scope of this report.

Standard of Care and Disclaimer of Warranties. This study and report have been prepared in accordance with generally accepted engineering and scientific judgments, principles and practices. McElhanney expressly disclaims any and all warranties in connection with this report including, without limitation, any warranty that this report and the associated site review work has uncovered all potential geotechnical liabilities associated with the subject property.

Effect of Changes. All evaluations and conclusions stated in this report are based on facts, observations, site-specific details, legislation and regulations as they existed at the time of the site assessment. Some conditions are subject to change over time, and the Client recognizes that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site may substantially alter such evaluations and conclusions. Construction activities can significantly alter soil, rock and other geologic conditions on the site. McElhanney should be requested to re-evaluate the conclusions of this report and to provide amendments as required prior to any reliance upon the information presented herein upon any of the following events: a) any changes (or possible changes) as to the site, purpose, or development plans upon which this report was based, b) any changes to applicable laws subsequent to the issuance of the report, c) new information is discovered in the future during site excavations, construction, building demolition or other activities, or d) additional subsurface assessments or testing conducted by others.

Subsurface Risks. Soil, rock and groundwater data were collected in general accordance with the standards and methods described in the document. The classification and identification of soils, rocks, and geologic formations was based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Interpretations of groundwater levels and flow direction are based on water level observations at selected test hole locations and are expected to fluctuate. Observations at test holes indicate the approximate subsurface conditions at those locations only. Subsurface conditions between test holes were based, by necessity, on judgement and assumptions of what exists between the actual locations sampled and may vary significantly from actual site conditions and all persons making use of this report should be aware of and accept this risk. Even a comprehensive sampling and testing program, implemented in accordance with appropriate equipment by experienced personnel, may fail to detect all or certain conditions.

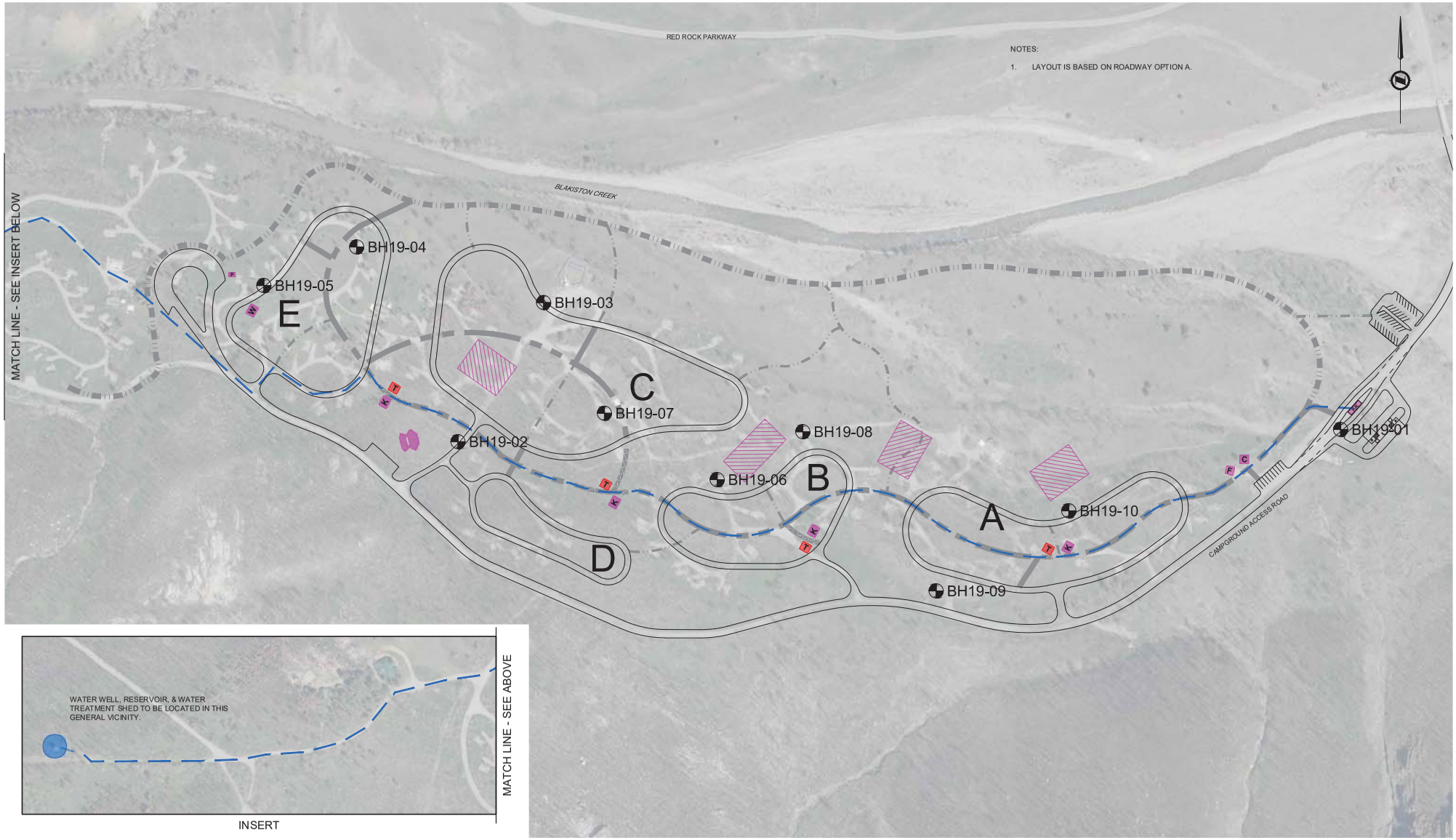
Information from Client and Third Parties. McElhanney has relied in good faith on information provided by the Client and third parties noted in this report and has assumed such information to be accurate, complete, reliable, non-fringing, and fit for the intended purpose without independent verification. McElhanney accepts no responsibility for any deficiency, misstatements or inaccuracy contained in this report as a result of omissions or errors in information provided by third parties or for omissions, misstatements or fraudulent acts of persons interviewed.

Underground Utilities and Damages. In the performance of the services, McElhanney has taken reasonable precautions to avoid damage or injury to subterranean structures or utilities. Subsurface sampling may result in unavoidable contamination of certain subsurface areas not known to be previously contaminated such as, but not limited to, a geologic formation, the groundwater or other hydrous body. McElhanney will adhere to an appropriate standard of care during the conduct of any subsurface sampling.

Independent Judgments. McElhanney will not be responsible for the independent conclusions, interpretations, interpolations and/or decisions of the Client, or others, who may come into possession of this report, or any part thereof. This restriction of liability includes decisions made to purchase, finance or sell land or with respect to public offerings for the sale of securities.

Construction. The subsurface information contained in this report were obtained for the owner's information and design. The extent and detail of assessments necessary to determine all relevant conditions that may affect construction costs would normally be greater than the assessments carried out for this report. Accordingly, a contingency fund to allow for the possibility of variations of subsurface conditions should be included in the construction budget to cover costs associated with modifications of the design and construction procedures resulting from conditions that vary from the assumptions in this report. If during construction, subsurface conditions are found to be other than those described in this report, McElhanney is to be notified and may alter or modify the geotechnical report recommendations. If McElhanney is not retained to provide services during construction, then McElhanney is not responsible for confirming or recording that subsurface conditions do not materially differ from those interpreted conditions contained in this report or for confirming or recording that construction activities have not adversely affected subsurface conditions or the recommendations contained in this report.

APPENDIX A – BOREHOLE SITE PLAN



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Legend:

- T Washroom
- W Winter Kitchen
- K Kitchen Shelter
- KK Kiosk
- P Privy
- C Concession
- Amphitheatre
- Septic Field
- F Firewood
- Water main

20 0 50
1:3000

Borehole Plan - Showing Building Placement & Servicing

Option A

Crandell Campground Reconstruction

Appendix A

APPENDIX B – BOREHOLE LOGS

SUMMARY LOG

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Borehole #: **BH19-01**

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Prepared by: 2511-01195-00
Marcus Brown

Logged by: JAB Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442674.407 , 284995.826 Station/Offset:
Elevation: 1374.43 m *Coordinates Surveyed 8/7/2019*

Date(s) Drilled: 8/7/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: Hollow-stem

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	DRILLING DETAILS	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0			G1			SAND, some silt, trace gravel, loose, brown.	SM		1374
			SPT01			0.75m			
1			G2			GRAVEL and SAND, some silt, well graded, possible cobbles	GW-SW	SPT @ 0.75m, 2/2/3 **Sieve** (Sa#G2) Gravel:60% Sand:35% Fines:5%	1373
			SPT02			1.5m		SPT @ 1.5m, 7/14/22/10	
						End of hole at 1.5 m due to auger refusal. No groundwater seepage observed.			
2									1372
3									1371
4									1370
5									1369
6									1368
7									1367
8									1366
9									1365
10									

5.1

Legend
Sample Type:
A-Auger C-Core G-Grab V-Vane
L#-Lab Sample S-Split Spoon O-Odex (air rotary) W-Wash (mud return) T-Shelby Tube

Final Depth of Hole: 1.6 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Borehole #: **BH19-02**

Date(s) Drilled: 8/8/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

Prepared by: 2511-01195-00
Marcus Brown

Logged by: JAB Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442664.154 , 284251.133 Station/Offset:
Elevation: 1386.9 m *Coordinates Surveyed 8/7/2019*

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	DRILLING DETAILS	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	MONITORING WELL	ELEVATION (m)
0						GRAVEL and SAND, well graded, dry, loose.		**Sieve** (Sa#G1) Gravel:58% Sand:40% Fines:2%		
1			G1							1386
			SPT01				GW-SW	SPT @ 1.5 m, 3/4/17/15		
2			G2							1385
3			SPT02							1384
			G3			GRAVEL, sandy, some fines, red-brown, moist, weak cementation, non-plastic. (3.0m – 3.2m)	GP	SPT @ 3.0 m, 9/8/6/5		
			SPT03			SAND and GRAVEL, trace silt, red-brown, dry, weak cementation, non-plastic.	SW-GW			
4										1383
						SAND, medium to coarse, gravelly, trace fines, brown, moist weak cementation, non plastic. (4.5m – 6.0m)	SW	SPT @ 4.5 m, 28/50, refusal at 300 mm		
5			G4							1382
6			SPT04			End of hole at 6.0 m. No groundwater seepage observed.		1" dia. standpipe installed to 6 mbgs. Slots cut every 2 to 4 cm from 0.5 mbgs to 6 mbgs. Standpipe capped with bentonite from 0.3 mbgs to 0.5 mbgs SPT @ 6.0 m, 13/13/19/27		1381
7										1380
8										1379
9										1378
10										1377

Legend Sample Type: A-Auger, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 6.0 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Borehole #: **BH19-03**

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Prepared by: 2511-01195-00
Marcus Brown

Logged by: JAB Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442781.438 , 284323.372 Station/Offset:
Elevation: 1383.57 m *Coordinates Surveyed 8/7/2019*

Date(s) Drilled: 8/8/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	SAMPLE NO	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0		GRAVEL and SAND, trace fines, brown, dry to moist.	GW-GM/GC	**Sieve** (Sa#G1) Gravel:51% Sand:43% Fines:6%	1383
1	G1				
1.5	SPT01	GRAVEL, sandy, trace fines, dry, compact to dense.	GP	SPT @ 1.5 m, 12/25/25/40	1382
2	G2				1381
3.0	SPT02	SAND, some gravel, some fines, red-browm, moist, weak cementation, low plasticity.	SP	SPT @ 3.0 m, 3/19/24/27	
3.2		GRAVEL, sandy, trace fines, moist, dense.	GP		1380
3	G3				
4.5	SPT03	End of hole at 4.5 m. No groundwater seepage observed.		1" dia. standpipe installed to 4.5 mbgs. Slots cut every 2 to 4 cm from 0.5 mbgs to 4.5 mbgs. Standpipe capped with bentonite from 0.3 mbgs to 0.5 mbgs SPT @ 4.5m, 12/19/26/40	1379
5					1378
6					1377
7					1376
8					1375
9					1374
10					

3.3

Legend Sample Type: A-Auger, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 4.5 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Borehole #: **BH19-04**

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Prepared by: 2511-01195-00
Marcus Brown

Logged by: MVO Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442828.369 , 284165.656 Station/Offset:
Elevation: 1387.71 m *Coordinates Surveyed 8/7/2019*

Date(s) Drilled: 8/8/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	SAMPLE NO	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0		TOPSOIL (0.05m)	TS		
	G1	GRAVEL, some sand, trace fines, well graded, brown, dry, loose, brown and red clayey inclusions, possible sub-rounded to sub-angular cobbles and boulders.			1387
1	S1		GW	SPT @ 1.5 m, 4/5/5/6 **Sieve** (Sa#G2) Gravel:67% Sand:30% Fines:3%	1386
2 (2.6)	G2				1385
3	S2	Possibly less cobbles and boulders. (3.0m)		SPT @ 3.0 m, refusal at 25 mm, no recovery	
	G3		GW		1384
4	S3	End of hole at 4.5 m. No groundwater seepage observed. (4.5m)		SPT @ 4.5 m, 8/12/15/20	1383
5					1382
6					1381
7					1380
8					1379
9					1378
10					

Legend
Sample Type:
A-Auger, C-Core, G-Grab, V-Vane
L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 4.5 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Borehole #: **BH19-05**

Date(s) Drilled: 8/9/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

Prepared by: 2511-01195-00
Marcus Brown
Logged by: MVO Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442795.813 , 284087.311 Station/Offset:
Elevation: 1390.37 m *Coordinates Surveyed 8/7/2019*

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	DRILLING DETAILS	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0						TOPSOIL 0.05m	TS		
						SAND and GRAVEL, trace fines, poorly graded, brown, dry, loose, possible sub-rounded to sub-angular cobbles and boulders.	SP-SM/SC	**Sieve** (Sa#G1) Gravel:40% Sand:51% Fines:9%	1390
1	4.8		G1						
			S1					SPT @ 1.5 m, 3/5/7/6	1389
						GRAVEL, sandy, silty, grey-brown, moist, compact, red clayey inclusions. 1.7m			
2			G2						1388
3			S2				GP	SPT @ 3.0 m, 14/8/15/13	1387
4			G3						1386
			S3			End of hole at 4.5 m. No groundwater seepage observed. 4.5m		SPT @ 4.5 m, refusal at 25 mm, no recovery	
5									1385
6									1384
7									1383
8									1382
9									1381
10									

Legend
Sample Type: A-Auger, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 4.5 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Borehole #: **BH19-06**

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Prepared by: 2511-01195-00
Marcus Brown

Logged by: MVO Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442632.153 , 284469.846 Station/Offset:
Elevation: 1381.52 m *Coordinates Surveyed 8/7/2019*

Date(s) Drilled: 8/8/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	DRILLING DETAILS	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0						TOPSOIL 0.05m	TS		
			G1			SAND and GRAVEL, trace fines, well graded, grey-brown, moist, compact, red clayey inclusions, possible cobbles.		**Sieve** (Sa#G1) Gravel:38% Sand:58% Fines:4%	1381
1	2.6					Sand content increasing from 0.3 mbgs.			
			S1					SPT @ 1.5 m, 9/10/11/14	1380
2			G2				SW-GW		1379
3			S2					SPT @ 3.0 m, refusal, no recovery	1378
			G3						
4			S3			4.5m End of hole at 4.5 m. No groundwater seepage observed.		SPT @ 4.5 m, 10/12/17/12	1377
5									1376
6									1375
7									1374
8									1373
9									1372
10									

Legend
Sample Type:
A-Auger, C-Core, G-Grab, V-Vane
L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 4.5 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Borehole #: **BH19-07**

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Prepared by: 2511-01195-00
Marcus Brown

Logged by: MVO Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442688.123 , 284374.682 Station/Offset:
Elevation: 1383.46 m *Coordinates Surveyed 8/7/2019*

Date(s) Drilled: 8/8/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	SAMPLE NO	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0		TOPSOIL (0.05m)	TS		
		GRAVEL, some sand, well graded, brown, dry, loose, possible sub-rounded to sub-angular cobbles and boulders. (0.4m)	GW		1383
1	G1	SAND and GRAVEL, trace to some fines, well graded, grey-brown, moist, compact to dense, red clayey inclusions.			
	S1			SPT @ 1.5m, 12/17/17/18 **Sieve** (Sa#G2) Gravel:48% Sand:49% Fines:3%	1382
2	G2		SW-GW		1381
3	S2			SPT @ 3.0 m, refusal at 25 mm, no recovery	1380
	G3				
4	S3	End of hole at 4.5 m. No groundwater seepage observed. (4.5m)		SPT @ 4.5m, refusal at 50 mm	1379
5					1378
6					1377
7					1376
8					1375
9					1374
10					

Legend
Sample Type:
A-Auger, C-Core, G-Grab, V-Vane
L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 4.5 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Borehole #: **BH19-08**

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Prepared by: 2511-01195-00
Marcus Brown

Logged by: MVO Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442672.54 , 284542.088 Station/Offset:
Elevation: 1380.95 m *Coordinates Surveyed 8/7/2019*

Date(s) Drilled: 8/9/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	SAMPLE NO	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0		TOPSOIL (0.05m)	TS		
	G1	GRAVEL, some sand, trace fines, well graded, brown, dry, loose, possible sub-rounded to sub-angular cobbles and boulders. (1.2m)	GW		1380
1	S1	GRAVEL and SAND, trace fines, well graded, grey-brown, moist, compact, red clayey inclusions		SPT @ 1.5 m, 8/11/14/10	
2	G2				1379
3	S2		GW-SW	SPT @ 3.0m, refusal @ 25 mm, no recovery **Sieve** (Sa#G3) Gravel:56% Sand:41% Fines:3%	1378
	G3				
4	S3	End of hole at 4.5 m. No groundwater seepage observed. (4.5m)		SPT @ 4.5 m, refusal at 25 mm, no recovery	1377
5					1376
6					1375
7					1374
8					1373
9					1372
10					

2.1

Legend
Sample Type:
A-Auger, C-Core, G-Grab, V-Vane
L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 4.5 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Borehole #: **BH19-09**

Date(s) Drilled: 8/9/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

Prepared by: 2511-01195-00
Marcus Brown

Logged by: MVO Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442538.298 , 284654.532 Station/Offset:
Elevation: 1379.2 m *Coordinates Surveyed 8/7/2019*

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	DRILLING DETAILS	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0						TOPSOIL (0.05m)	TS		1379
			G1			SAND and GRAVEL, trace fines, well graded, brown, dry, loose, possible sub-rounded to sub-angular cobbles and boulders. (0.9m)	SW-GW	**Sieve** (Sa#G1) Gravel:46% Sand:50% Fines:4%	
1						GRAVEL, sandy, some silt, grey-brown, moist, compact, red clayey inclusions			1378
			S1					SPT @ 1.5 m, 12/11/9/14	
2							GP		1377
			G2						
	Water-2.8m					(2.8m)		Groundwater seepage observed	
3			S2			GRAVEL, sandy, some fines, red-brown, moist to saturated, compact.		SPT @ 3.0 m, 20/17, refusal at 300 mm	1376
			G3				GP		
4									1375
			S3			(4.5m) End of hole at 4.5 m. Groundwater seepage observed at 2.8m.		SPT @ 4.5 m, refusal at 50 mm, no recovery	
5									1374
6									1373
7									1372
8									1371
9									1370
10									

Legend
Sample Type:
A-Auger, C-Core, G-Grab, V-Vane
L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 4.5 m
Depth to Top of Rock:

SUMMARY LOG

McElhanney

Project: **Crandell Mountain Campground Reconstruction**
Location: Waterton National Park

Borehole #: **BH19-10**

Date(s) Drilled: 8/9/19
Drilling Company: Core Drilling
Driller: Joel
Drill Model: Track Mounted Rig
Drilling Method: ODEX

Prepared by: 2511-01195-00
Marcus Brown
Logged by: MVO Reviewed by: RG

Datum: NAD83 Alignment:
Northing/Easting: 5442605.852 , 284766.513 Station/Offset:
Elevation: 1377.94 m *Coordinates Surveyed 8/7/2019*

✕ Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400
✳ DYNAMIC CONE (BLOWS/300 mm) ✳
+ Natural Vane (KPa) ⊕ Remold Vane (KPa)
▲ SPT "N" (BLOWS/300 mm)
W_P% W% W_L% 20 40 60 80

DEPTH (m)	SAMPLE NO	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS	ELEVATION (m)
0		TOPSOIL (0.05m)	TS		
	G1	GRAVEL, well graded, brown, dry, loose, possible cobbles and boulders.	GW		
1		SAND and GRAVEL, well graded, grey-brown, dry, loose, red clayey inclusions, possible cobbles boulders. (1.0m)			1377
	S1			SPT @ 1.5 m, 11/14/9/13	
2				**Sieve** (Sa#G2) Gravel:44% Sand:51% Fines:5%	1376
2.5	G2				
			GW-GM/GC		
3	S2			SPT @ 3.0 m, 20/16/14/17	1375
	G3				
4					1374
	S3	End of hole at 4.5 m. No groundwater seepage observed. (4.5m)		SPT @ 4.5 m, 20/17/19/21	
5					1373
6					1372
7					1371
8					1370
9					1369
10					1368

Legend
Sample Type:
A-Auger, C-Core, G-Grab, V-Vane
L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 4.5 m
Depth to Top of Rock:

APPENDIX C – LABORATORY TESTING RESULTS

PHONE: 250-489-1940 FAX: 250-489-1667 EMAIL: info@artechconsulting.ca
229 Industrial Rd F, Cranbrook, BC V1C 6N4 www.artechconsulting.ca

ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

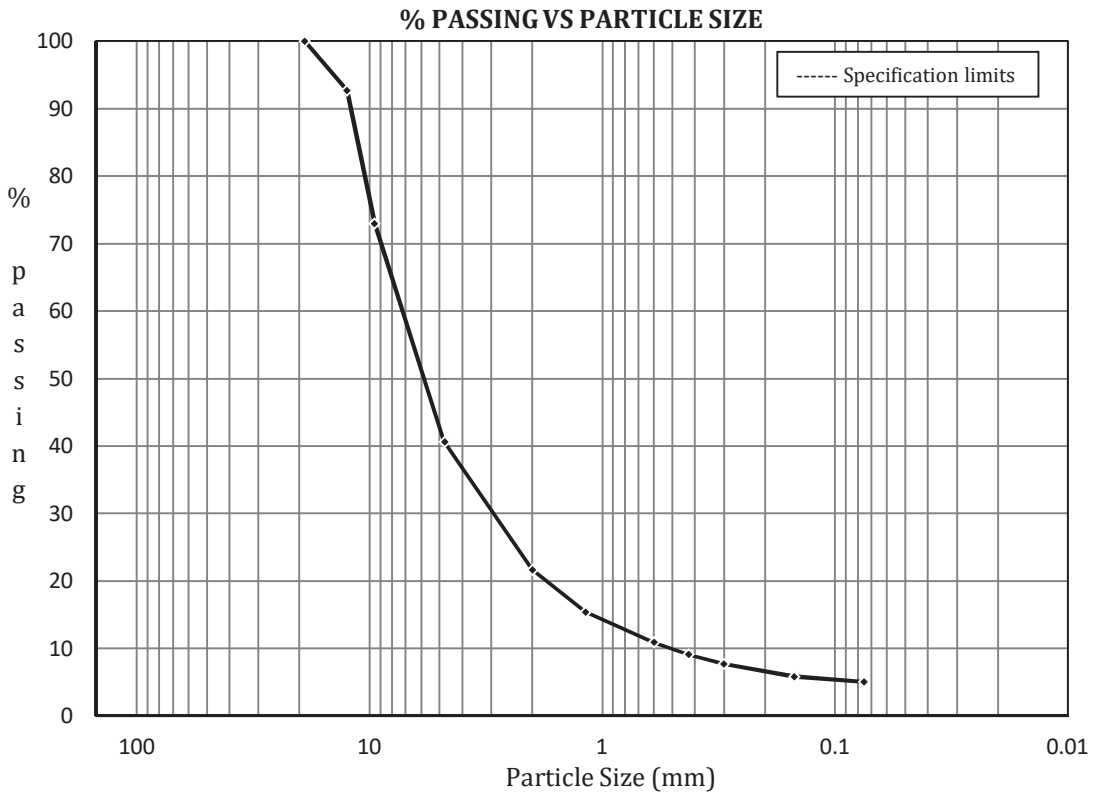
Lab ID: S19520
Client Project: Crandell
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-01 S5 (6.0m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5		
19.0	100.0	
12.5	92.6	
9.5	73.0	
4.75	40.6	
2.00	21.7	
1.18	15.4	
0.600	10.9	
0.425	9.1	
0.300	7.7	
0.150	5.8	
0.075	5.0	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	59.4	%
Sand :	< 4.75mm and > 0.075mm	35.5	%
Silt/Clay :	< 0.075mm	5.0	%

Moisture Content: 5.1 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
Bryan Morrison, BSc.

PHONE: 250-489-1940 FAX: 250-489-1667 EMAIL: info@artechconsulting.ca
229 Industrial Rd F, Cranbrook, BC V1C 6N4 www.artechconsulting.ca

ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

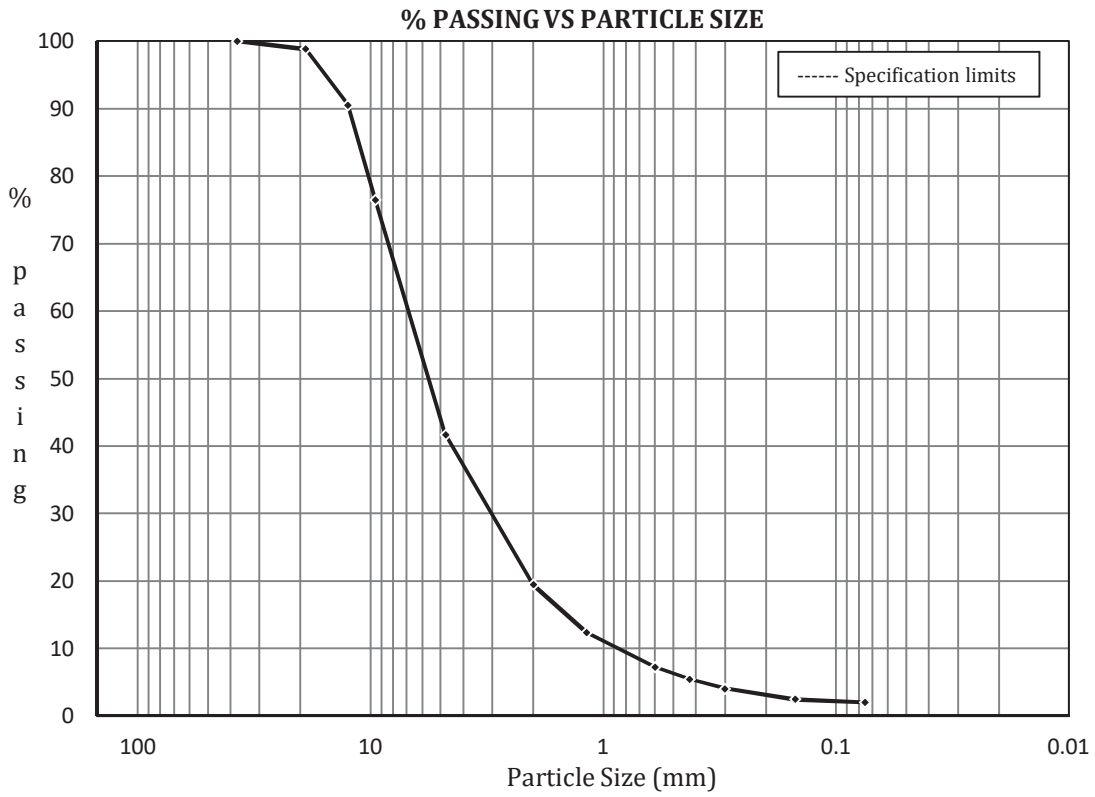
Lab ID: S19521
Client Project: Crandell
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-02 G2 (1.5-3.0m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5	100.0	
19.0	98.8	
12.5	90.5	
9.5	76.4	
4.75	41.7	
2.00	19.4	
1.18	12.4	
0.600	7.3	
0.425	5.5	
0.300	4.1	
0.150	2.5	
0.075	2.1	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	58.3	%
Sand :	< 4.75mm and > 0.075mm	39.6	%
Silt/Clay :	< 0.075mm	2.1	%

Moisture Content: 1.0 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
Bryan Morrison, BSc.

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229 Industrial Rd F, Cranbrook, BC V1C 6N4 www.artechconsulting.ca

ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

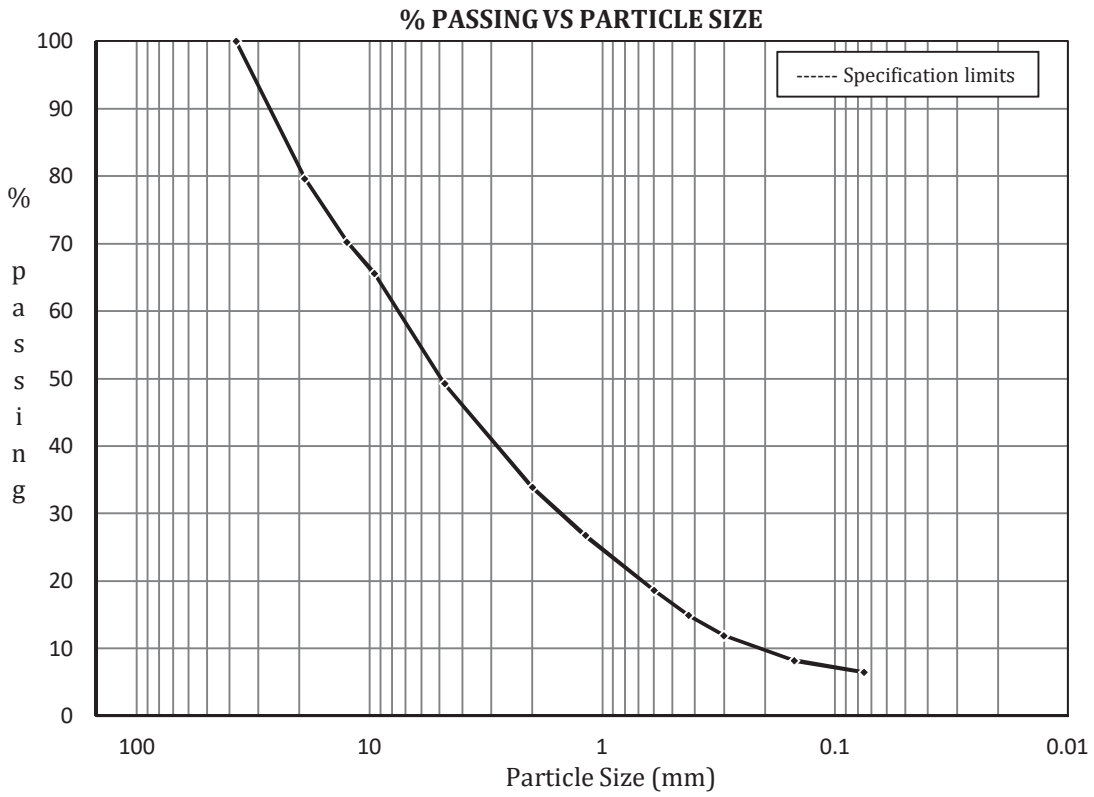
Lab ID: S19522
Client Project: Crandell
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-03 Grab (0-1.5m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5	100.0	
19.0	79.6	
12.5	70.2	
9.5	65.5	
4.75	49.2	
2.00	33.9	
1.18	26.8	
0.600	18.7	
0.425	14.9	
0.300	11.9	
0.150	8.2	
0.075	6.5	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	50.8	%
Sand :	< 4.75mm and > 0.075mm	42.7	%
Silt/Clay :	< 0.075mm	6.5	%

Moisture Content: 3.3 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
Bryan Morrison, BSc.

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229 Industrial Rd F, Cranbrook, BC V1C 6N4 www.artechconsulting.ca

ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

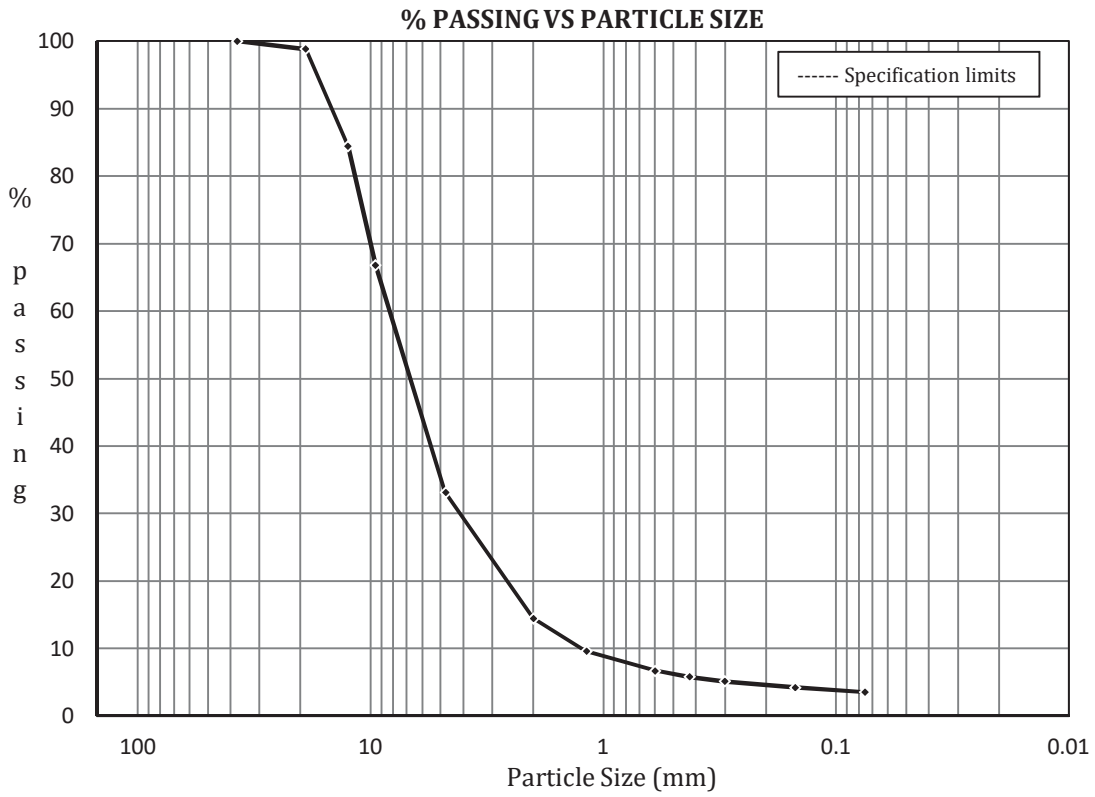
Lab ID: S19523
Client Project: Crandell
Date Received: August 13, 2019

Sample Description: Sandy GRAVEL, trace silt/clay
Sample ID: BH19-04 G2 (1.5-3.0m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5	100.0	
19.0	98.8	
12.5	84.4	
9.5	66.8	
4.75	33.1	
2.00	14.5	
1.18	9.6	
0.600	6.7	
0.425	5.8	
0.300	5.1	
0.150	4.2	
0.075	3.6	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	66.9	%
Sand :	< 4.75mm and > 0.075mm	29.6	%
Silt/Clay :	< 0.075mm	3.6	%

Moisture Content: 2.6 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By: Bryan Morrison, BSc.

PHONE: 250-489-1940 FAX: 250-489-1667 EMAIL: info@artechconsulting.ca
229 Industrial Rd F, Cranbrook, BC V1C 6N4 www.artechconsulting.ca

ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

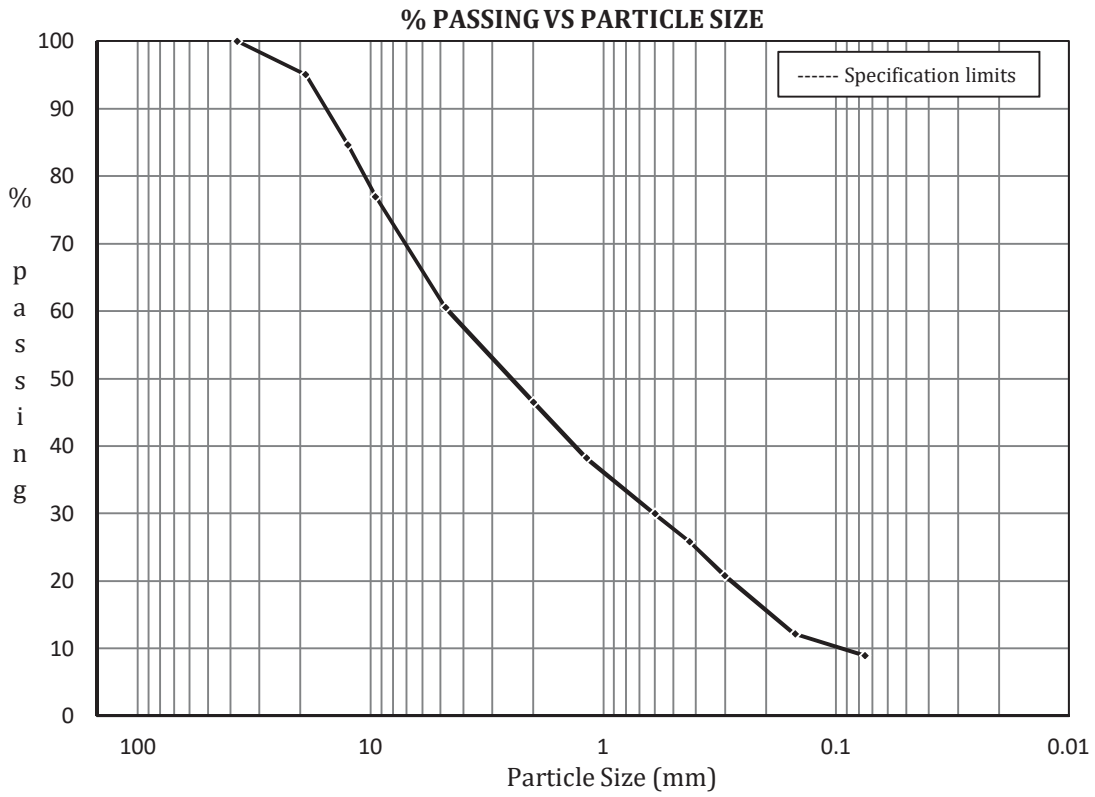
Lab ID: S19524
Client Project: Crandell
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-05 G1 (0-1.5m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5	100.0	
19.0	95.0	
12.5	84.6	
9.5	77.0	
4.75	60.5	
2.00	46.5	
1.18	38.2	
0.600	30.0	
0.425	25.8	
0.300	20.8	
0.150	12.2	
0.075	9.0	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	39.5	%
Sand :	< 4.75mm and > 0.075mm	51.6	%
Silt/Clay :	< 0.075mm	9.0	%

Moisture Content: 4.8 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
Bryan Morrison, BSc.

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ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

Lab ID: S19525
Client Project: Crandell

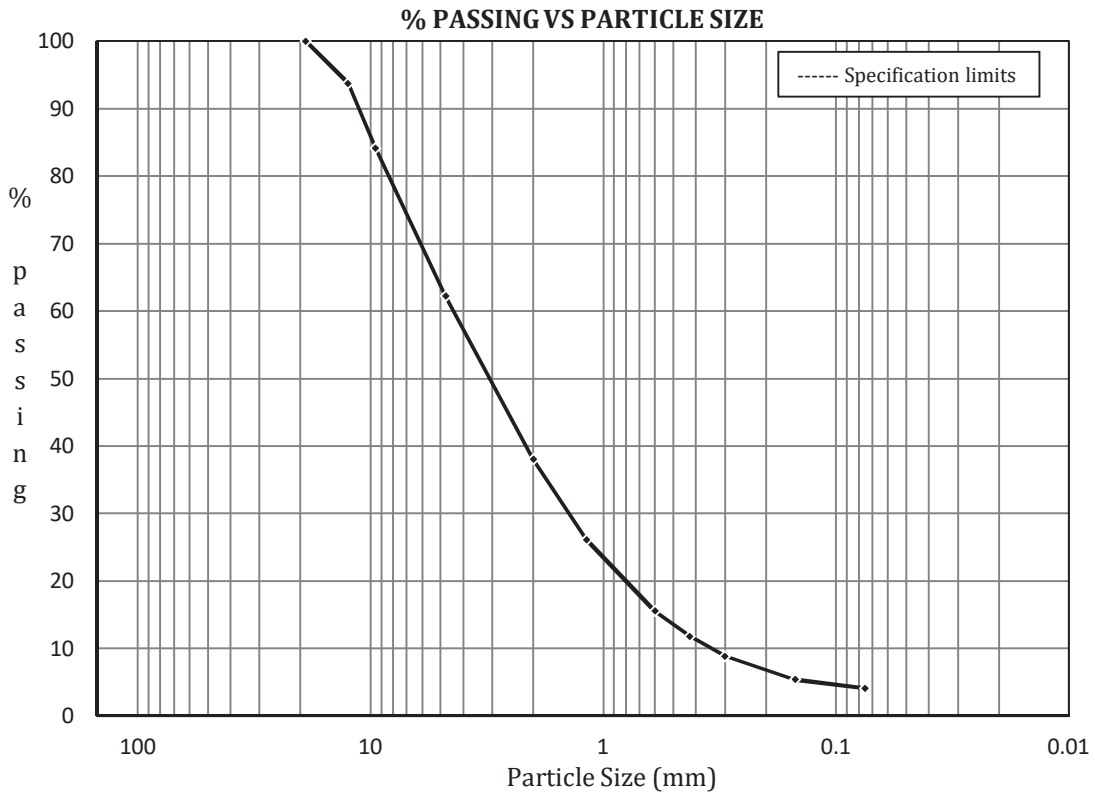
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-06 G1 (0-1.5m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5		
19.0	100.0	
12.5	93.7	
9.5	84.1	
4.75	62.2	
2.00	38.0	
1.18	26.1	
0.600	15.6	
0.425	11.8	
0.300	8.9	
0.150	5.4	
0.075	4.1	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	37.8	%
Sand :	< 4.75mm and > 0.075mm	58.1	%
Silt/Clay :	< 0.075mm	4.1	%

Moisture Content: 2.6 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
Bryan Morrison, BSc.

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ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

Lab ID: S19526
Client Project: Crandell

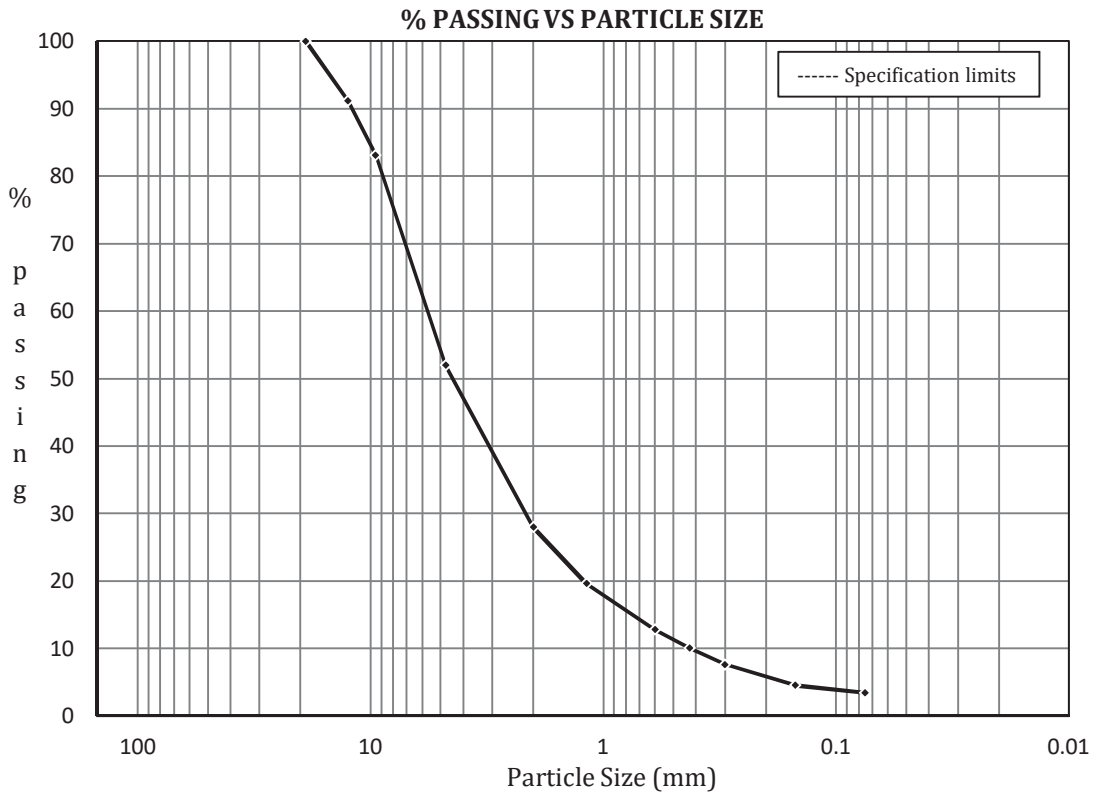
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-07 G1 (1.5-3.0m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5		
19.0	100.0	
12.5	91.1	
9.5	83.1	
4.75	52.0	
2.00	28.0	
1.18	19.6	
0.600	12.8	
0.425	10.0	
0.300	7.6	
0.150	4.6	
0.075	3.4	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	48.0	%
Sand :	< 4.75mm and > 0.075mm	48.5	%
Silt/Clay :	< 0.075mm	3.4	%

Moisture Content: 1.6 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
Bryan Morrison, BSc.

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ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

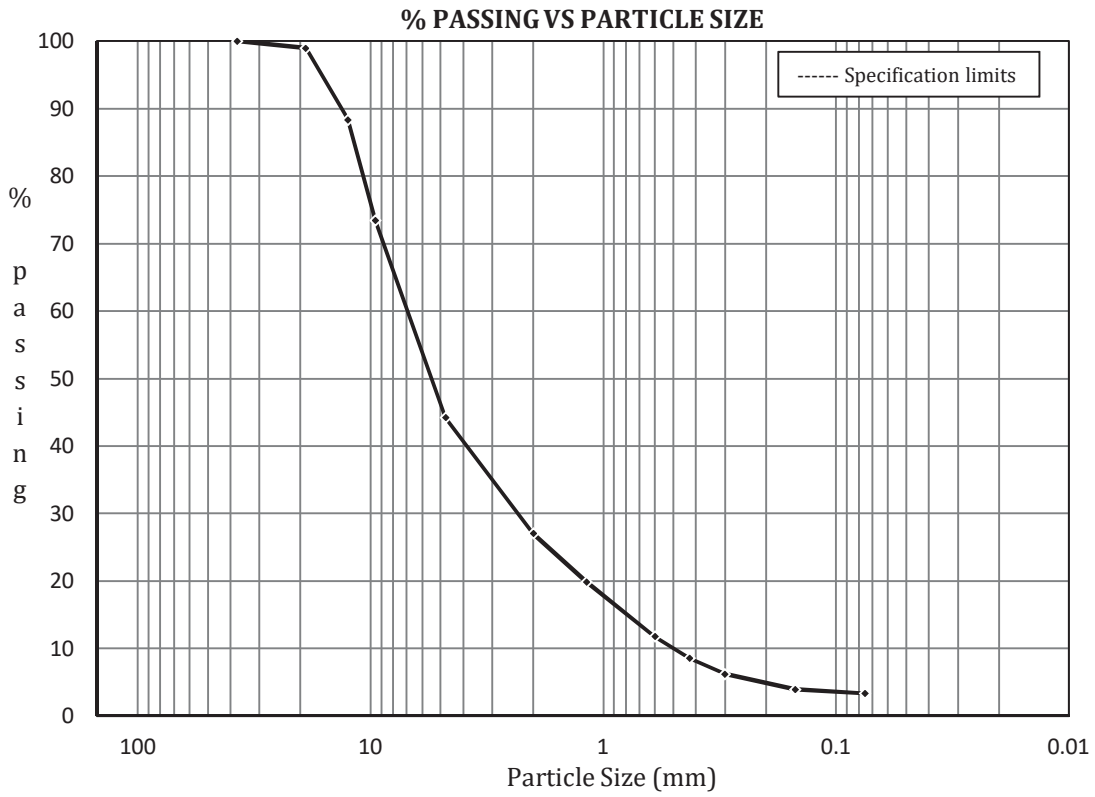
Lab ID: S19527
Client Project: Crandell
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-08 G3 (3-4.5m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5	100.0	
19.0	98.9	
12.5	88.3	
9.5	73.4	
4.75	44.2	
2.00	27.0	
1.18	19.9	
0.600	11.8	
0.425	8.5	
0.300	6.2	
0.150	4.0	
0.075	3.3	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	55.8	%
Sand :	< 4.75mm and > 0.075mm	40.8	%
Silt/Clay :	< 0.075mm	3.3	%

Moisture Content: 2.1 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
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ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

Lab ID: S19528
Client Project: Crandell

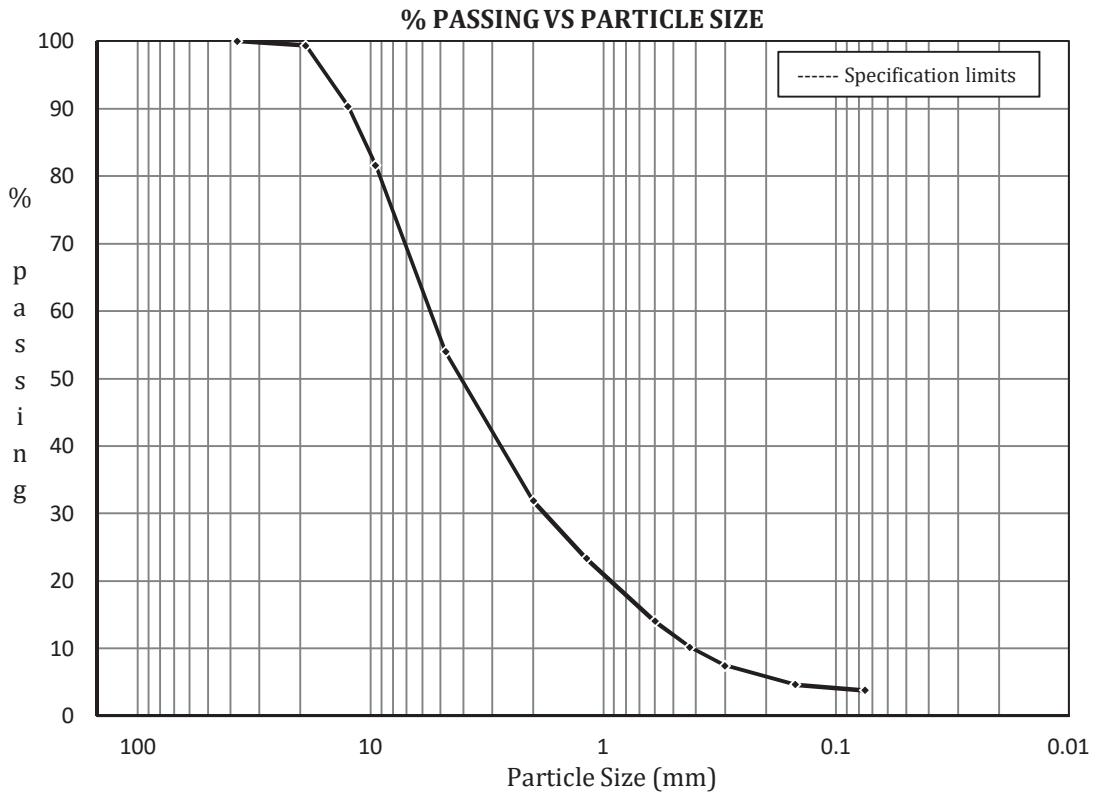
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-09 G1 (0-1.5m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5	100.0	
19.0	99.3	
12.5	90.3	
9.5	81.6	
4.75	54.0	
2.00	31.9	
1.18	23.3	
0.600	14.1	
0.425	10.2	
0.300	7.5	
0.150	4.7	
0.075	3.8	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	46.0	%
Sand :	< 4.75mm and > 0.075mm	50.2	%
Silt/Clay :	< 0.075mm	3.8	%

Moisture Content: 1.9 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
Bryan Morrison, BSc.

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ARTECH CONSULTING LTD.

PARTICLE SIZE ANALYSIS

Project No: 19.0013.AR
Project: McElhanney General
Client: McElhanney Consulting Services Ltd.

Attn: Ryan Gibbard
CC: -

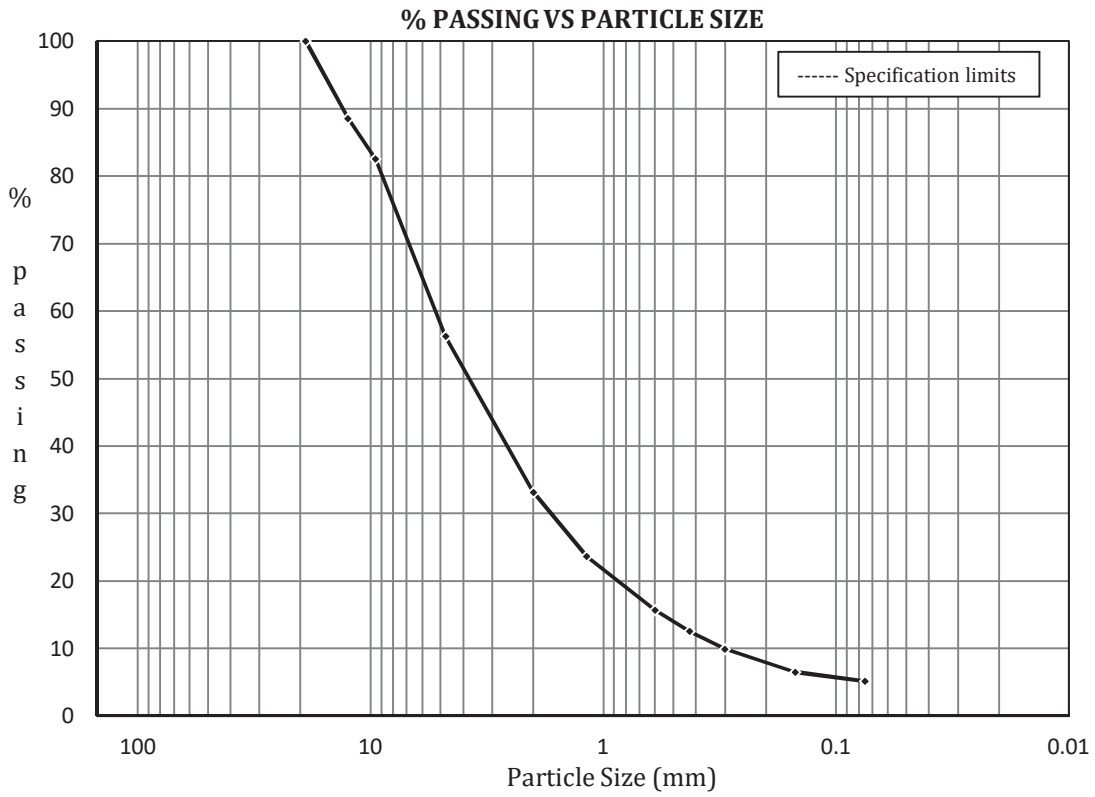
Lab ID: S19529
Client Project: Crandell
Date Received: August 13, 2019

Sample Description: GRAVEL and SAND, trace silt/clay
Sample ID: BH19-10 G2 (1.5-3.0m)
Sample Source: Geotechnical Investigation

Sample Date: -
Sample Time: -
Sampled By: Client

Specification: NA

Sieve Analysis		
Sieve Size (mm)	% Passing	Specification limits
100.0		
75.0		
37.5		
19.0	100.0	
12.5	88.5	
9.5	82.5	
4.75	56.2	
2.00	33.1	
1.18	23.7	
0.600	15.7	
0.425	12.6	
0.300	9.9	
0.150	6.5	
0.075	5.2	



Summary

Cobble :	>75mm		%
Gravel :	< 75mm and > 4.75mm	43.8	%
Sand :	< 4.75mm and > 0.075mm	51.0	%
Silt/Clay :	< 0.075mm	5.2	%

Moisture Content: 2.5 %

Comments: -

Tested in accordance with ASTM C136 Sieve Analysis of Fine and Coarse Aggregates /C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Report Date: August 16, 2019

Reviewed By:
Bryan Morrison, BSc.

Appendix F

Crandell Mountain Campground Reconstruction Project –

Construction Environmental Management Plan (CEMP)

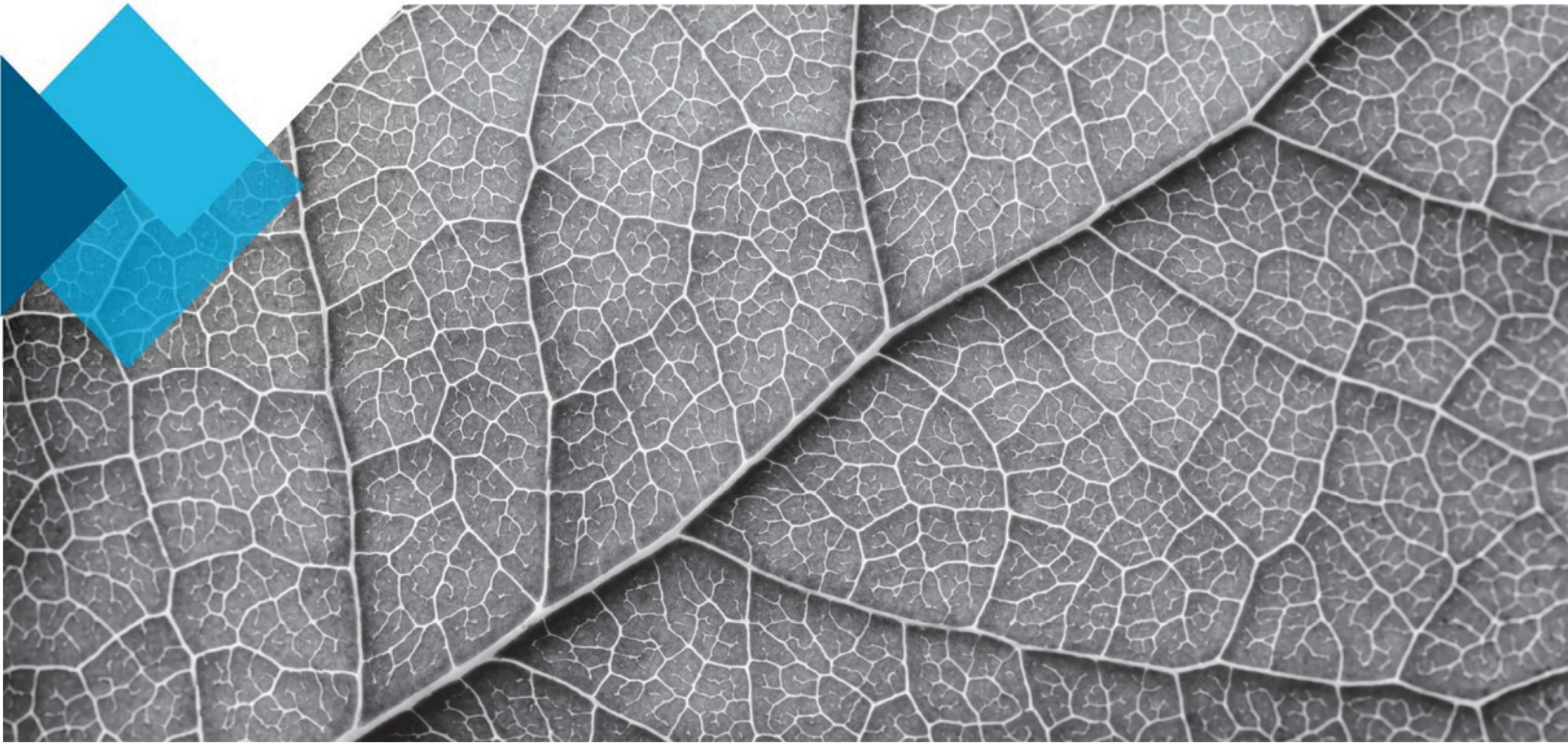
March 5, 2020

SNC·LAVALIN

Crandell Mountain Campground Reconstruction Project

Construction Environmental Management Plan (CEMP)

Parks Canada – Waterton Lakes National Park



Environment & Geoscience

March 5, 2020

Internal Ref: 666069

Revision Index

Revision #	Date	Description	Approval	
1	05/04/2020	CEMP for tender package	Prepared by	Lawrence Lam, M.Sc. Biologist
			Reviewed by	Jamie Page, B.Sc. Environmental and Regulatory Specialist
			Approved by	Jason Russell, P.Eng. Senior Project Manager

Table of Contents

Appendices

1 Introduction

SNC-Lavalin Inc. (SNC-Lavalin) prepared this Construction Environmental Management Plan (CEMP) for Parks Canada's (PCA's) Crandell Mountain Campground (CMC) reconstruction project. The CMC is located in Waterton Lakes National Park, Alberta, approximately 6 km northwest of the Town of Waterton.

The CEMP is a living document and may require alteration during construction to accommodate for changes in environmental conditions, legislative requirements, and/or construction activities. Revisions to this document will require approval by PCA and will result in a formal issuance of an amended version of this document. All previous versions will be considered superseded following the issuance of revisions to this CEMP.

The CEMP covers the following Project activities:

Site preparation	› Brushing, stripping and grubbing › Earthworks (grading, excavation, etc.) › Demolition (remaining two concrete buildings, asphalt etc.) › Decommissioning of existing septic infrastructure › Use of machinery
Construction of CMC infrastructure	› Paving of roads › Grading › Building and campsite construction › Trenching and installation of underground infrastructure (cables, water/sewer lines) › Construction of trails › Installation of new water reservoir (tank) and treatment facility › Septic field construction › Use of machinery
Vehicular traffic	› User and operations personnel traffic within CMC and surrounding area
Use of water / power / gas resources	› Installation and use of new water well › Decommissioning of old water well
Air emissions (greenhouse gases [GHG])	› Equipment use during construction
Unplanned events	› Spills and releases › Fire

1.1 Scope

The CEMP outlines specific environmental management, protection, and contingency measures that will be utilized during reconstruction of the CMC. The CEMP is a plan for all project personnel to avoid or minimize environmental impacts and assist in achieving compliance with applicable legislation, project approvals and the PCA BMPs. The CEMP includes guidance on:

- The roles and responsibilities of project personnel;
- Environmental sensitivities;
- Environmental legislation, approvals and commitments;
- Environmental management practices for all construction activities including:
  - Environmental shutdowns, variances, and stop work orders;
  - Surface water management;
  - Groundwater management;
  - Wildlife management;
  - Heritage resources management;
  - Soil management;
  - Erosion and sediment control;
  - Noise, air quality, and dust control;
  - Vehicles, equipment, and traffic management;
  - Material storage, handling and waste management; and
  - Spill prevention and emergency response.

Site security, worker safety and visitor safety are not included in the scope of this document. This document presents the minimum standard to provide contractors for environmental protection measures on work sites.

1.2 Applicable Legislation

Federal and provincial regulations and requirements applicable to the Project are listed in Table 1.1.

Table 1.1 Relevant legislation and regulations

Jurisdiction	Regulations and Standards
Federal	Canadian *National Parks Act* and Regulations *Species at Risk Act* *Migratory Birds Convention Act* *Fisheries Act*
Provincial	Alberta Private Sewage Systems Standard of Practice Alberta *Weed Control Act* and Regulations Alberta Forest and Prairie Protection (Ministerial) Regulation

2 Roles and Responsibilities during Construction

Environmental compliance will be achieved through effective communication, site-specific orientations, and environmental surveillance completed by qualified personnel. Contact information for responsible for ensuring compliance with project requirements include:

JASON RUSSELL, P. ENG.
SENIOR PROJECT MANAGER
CELLULAR TELEPHONE (403) 462-7632

KELLY MURRAY
SURVEILLANCE OFFICER
CELLULAR TELEPHONE (403) 632-5167

Roles and responsibilities of key resources are detailed in the following sections.

Project Manager (PM)

The Project Manager is accountable to deliver the project and is responsible for managing risk, scope, time and budget. The Project manager is the Technical Authority and is the contractor's unique point of contact. The Project manager reviews and develops contract change order and supporting documents and conducts pre-construction meetings and chairs project team meetings.

Impact Assessment Officer (IAO)

The Impact Assessment Officer is responsible for drafting and/or reviewing the EIA and ensuring that the scope of work of the environmental analysis complies with Parks Canada's responsibilities under the *Canadian Environmental Assessment Act* 2012 as well as all other relevant regulations and guidelines. The IAO may also function as the SO for project construction.

Surveillance Officer (SO)

The Surveillance Officer is responsible for on-site surveillance of the work in accordance with the PCA EIA and environmental regulations and guidelines. The SO will provide direction regarding environmental assessment / environmental infractions or emergencies through the Project Manager unless necessary. As the PCA representative for environmental concerns, the SO may consult with relevant specialists to determine appropriate implementation for mitigation measures. The SO has the authority to stop work for *National Parks Act* violations, however, during normal operations does not give direction to the Contractor.

Prime Contractor

The Prime Contractor is responsible for developing a site-specific Occupational Safety and Health Management Plan. The Prime Contractor is responsible for guarding the health and safety of those working on and visiting the site through implementing occupational safety and health induction training. The Prime contractor also obtains materials and labour necessary to successfully complete the project. The Prime contractor will engage and plan the work of sub-contractors and acquire all necessary licenses and permits, provide any required EIA construction planning documents for review (see Submissions Section) and record minutes of site meetings.

Banff Dispatch (403-762-1473)

911 proves 24-hour emergency dispatch services and will connect callers with emergency or other PCA services as required (e.g., Warden/Law Enforcement Services, Duty Officers). Banff dispatch at 403-762-1473 can be used for 24 hour notification to PCA in non-emergency situations. When calling, if unsure what services you require, request a Waterton Duty Officer.

2.1 Environmental Surveillance

All projects are subject to environmental surveillance by the SO to ensure that mitigation measures as outlined through the EIA process are implemented during all phases of construction, including clearing, grading, construction, cleanup, and restoration.

The SO will report deficiencies to the PM and summarize site visit observations in a surveillance report. The surveillance report will be filed into a database to supplement information for restoration activities in the future.

The Prime Contractor is responsible for keeping the SO informed of project activities and will notify the SO prior to the following activities:

- Vegetation clearing and soil stripping < 30 m from sensitive features;
- Activities in and < 30 m from water;
- Species at risk mitigation measures;
- Rare plant mitigation measures; and
- As otherwise outlined in this CEMP.

3 Environmental Protection Measures

Environmental protection and mitigation measures are detailed in the following section. These represent the minimum project standard that must be implemented during construction activities. Mitigation measures have been developed based on site specific conditions and environmental sensitivities and existing PCA best management practices contained in the following documents:

- Parks Canada – Waterton Lakes National Park: General Project Best Management Practices (2017); and
- Parks Canada – National Best Management Practices: Campground and Day Use Area Maintenance and Modification (2016).

3.1 General Project Mitigations

Mitigation measures applicable to all Project activities

Activity / Concern	Mitigation Measures
	›
Mobilization	› All employees must attend an environmental briefing with a SO before beginning work at the site to review and explain the mitigations that are conditions of the project approvals. Employees must attend this briefing before beginning their work at this site.
Site Preparation, Access, and Management	› Implement a construction closure of the area and ensure this is well communicated to Park visitors. › Maintain a safe working distance between work activities and visitors; consider the use of lookouts to manage traffic through the construction/hazard area. › Secure and clearly mark unattended safety hazards (e.g., excavations, debris piles) with fencing, warning signs, area closures or combination thereof.

Activity / Concern	Mitigation Measures
	› All PCA designated speed limits apply to construction vehicles. Additional speed restrictions may be required to protect visitor safety.
Work Site Conditions/Staging/ Laydown	› Minimize vegetation-clearing activities and ground disturbance by staging on existing hardened areas wherever possible. › Delineate the work zone; clearly mark the limits to active construction, sensitive features and the access and egress locations. › The Prime Contractor is responsible for security and safety of the work site. › Strong winds are a regular occurrence in WLNP. Prevent materials from blowing off of work site. › If contamination is found, cease work immediately and if necessary, implement Emergency Response Plan.
Vehicles and Equipment	› All equipment and vehicles will be made available for inspection by the SO on arrival to WLNP. The Prime Contractor will give 48 hours' notice and schedule equipment inspection with the SO. Water trucks require a written restricted activity permit from the SO to enter the Park. The permit is received at initial inspection. › Equipment must be properly tuned, clean and free of contaminants, in good operating order, free of leaks (e.g., fuel, oil or grease), and fitted with standard air emission control devices and spark arrestors prior to arrival on site. › Diesel equipment used on the project shall be fuelled with low sulfur diesel fuels and shall conform to local emission requirements. › Minimize idling of engines at all times. › Select equipment appropriate to the nature of work being conducted (e.g., avoid using large scale machinery when hand tools or smaller scale machinery could be used). › Equipment movements and workers' private vehicles shall be restricted to the designated footprint of the construction area. › Protective measures, including using appropriately sized equipment, or protective access matting must be employed if entry into wet areas is required. › Machinery must arrive on site in a clean and dry condition and be maintained free of fluid leaks, vegetative material (*i.e.,* invasive species, noxious weeds) and soils from off-site. All construction equipment from outside WLNP will be washed prior to arrival to minimize the risk of introducing weeds or aquatic invasive species. Additional weed-cleaning stations may be designated by the SO depending on project activities and locations (see table below). › Inspect equipment daily for fluid/fuel leaks and maintain equipment in good working order. › Equipment fuelling and maintenance sites will be identified by the Contractor and approved by the SO. Fuelling should occur on hardened areas > 100 m from streams, wetlands, waterbodies or watercourses. Fuelling personnel shall maintain presence at and provide immediate attention to the fuelling operation. › Mobile fuel containers (e.g., slip tanks) shall remain in the service vehicle at all times. › Operate machinery on land above the high water mark, on ice, or in another manner that minimizes disturbance to the banks and bed of any water body.

Activity / Concern	Mitigation Measures
	› Equipment that will work adjacent to a watercourse should be free of external grease, oil or other fluids, excessive mud, dirt and vegetation before entering the work area. Small Equipment › All small equipment (e.g., chainsaws, mowers, etc.) should be kept in good working condition and free of oil and fuel leaks. › Where possible, chain oil should be vegetable-based. › Fuelling of chainsaws will take place outside of riparian areas and sensitive features.
Site Clean Up/Waste Disposal	› Clean tools and equipment at an appropriate off-site facility to prevent the release of wash water that may contain deleterious substances. › Sweep up loose material or debris. Any material that may pose a risk of contamination to soils, surface water or groundwater should be disposed of appropriately off-site. › No construction waste (sawdust, soil, vegetation, debris, pumped water, hydrocarbon, chemicals, cement, asphalt, etc.) shall be allowed to enter an aquatic habitat or be deposited on undisturbed lands unless the said lands are part of the project works and approved for temporary waste storage. › Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried or discarded at the construction site or elsewhere in WLNP. These wastes shall be contained and removed in a timely and approved manner and disposed at an appropriate waste landfill site located outside WLNP. › Construction waste storage containers shall be emptied when 90% full. Waste containers will have lids, be wildlife proof if containing attractants, and waste loads shall be covered while being transported. › Sanitary facilities, such as a portable container toilet, shall be provided and maintained in a clean condition. Sanitary facilities must be in good condition and located away from sensitive resources including water bodies. › Camping and other recreational activities at the work site by contractors is not permitted without prior approval from the IAO and the Project Manager. These activities, if deemed appropriate, are conditional upon specific mitigations that address risks to wildlife, safety and any other additional environmental effects.
Cultural Resources	› All work in WLNP is subject to the accidental finds clause whereby on finding any unexpected Cultural Resources, workers shall stop work in the immediate area and notify the SO. PCAs Terrestrial Archaeology section will provide advice and assessment of significance and determine requirements to mitigate the chance find.
Surface Water	› Water withdrawal from Blakiston Creek will not be permitting during construction.

3.2 Spill Prevention and Emergency Response

Mitigation measures applicable to all Project activities

Activity / Concern	Mitigation Measures
Spill Prevention and Response	› The Prime Contractor is responsible for ensuring that a Spill Response Plan is developed prior to start of work and the plan is subject to approval by PCA. › The Prime Contractor is responsible for ensuring that spill kits sufficient to contain and clean up 110% of the site's largest possible fuel / chemical spill must be retained on site at each location of potential spills (sites where equipment is working). › The Prime Contractor is responsible for ensuring that all crew members and sub-consultants on site receive a briefing about the Spill Response Plan and are aware of the location and use of spill kits and containment devices.
	General Mitigations › Avoid work in high risk areas, particularly in areas of high water table, steep slopes or in close proximity to streams. › Have spill containment equipment on-hand and ensure that all personnel are aware of their location and trained in their use. › Absorbent booms must be immediately available on site during works in and near water. › Ensure all construction equipment is free of leaks from oil, fuel or hydraulic fuels. – All equipment and vehicles will be made available for inspection by the SO on arrival to WLNP. The Prime Contractor will give 48 hours' notice and schedule equipment inspection with the SO. Water trucks require a written restricted activity permit from the SO to enter the Park. The permit is received at initial inspection. › The crossing of any waterbody (including wetlands) by construction equipment, or the use of such equipment within waterbodies is strictly prohibited unless prior approval has been confirmed from the SO. › Designate refuelling areas at least 100 m away from any water body. Refuelling activities should not be conducted where run-off could carry contaminants into drainage pathways (including storm sewers). › Hazardous or toxic products shall be stored no closer than 100 metres from streams, wetlands, water bodies or waterways. › Equipment will be fuelled on hardened surfaces wherever possible. › Spill kits shall be provided at re-fuelling, lubrication, and repair locations. › Dispose of contaminated materials at provincially certified disposal sites outside of WLNP. No treatment of contaminated soils (e.g., bioremediation) is allowed in WLNP. All applicable documentation demonstrating proper disposal will be provided to Parks Canada. › If potentially hazardous materials (e.g. cement-based products, sealants or paints) are used on site ensure raw material, mixed compounds and wash water are not released to any watercourse or soils. Secondary containment measures such as collection/drip trays and berms lined with occlusive material such as plastic and a layer of sand, and double-lined fuel tanks are required. › All gas generators and water pumps require secondary containment. Electric pumps are preferred.

Activity / Concern	Mitigation Measures
	› Follow all applicable regulations and codes for the management and handling of hazardous waste. › The costs involved in a spill incident (the control, clean up, disposal of contaminants and site remediation to pre-spill conditions), shall be the responsibility of the Prime Contractor. The site will be inspected by the SO to ensure completion to the expected standard and to the satisfaction of PCA. › Timely and effective action shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. In the event of a major spill, all other work shall be stopped and all personnel devoted to spill containment and clean-up. › The SO shall be notified immediately of any spill. In the event of a major spill, Banff Dispatch (403-762-1473) shall be notified immediately along with the First Contact Authority (1-800-222-6514). › Definitions of major spills are included in Appendix 1.
	Minimum Requirements › The Spill Response Plan must at minimum, include the following information: – list of products and materials that are considered or defined as hazardous or toxic to the environment. Such products include, but are not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement, sand blasting agents, paint, solvents and hydrocarbons. – required equipment on site and location of spill kits. – spill prevention procedures (i.e., containment and storage of materials, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products in accordance with all applicable federal and provincial legislation). – fuelling procedures, fuel storage. – spill response (i.e., containment, clean-up, disposal of contaminated materials, etc.). – spill reporting procedure. – up-to-date emergency response contact list including contact information for reporting spills.
	Spill Reporting Requirements › Immediate spill reports are verbal notifications and must include all available information. Follow-up written spill reports must include the following: – Prime Contractor Name – Name and Contact Number – Location and time the spill occurred – Type and quantity of the substance spilled – Cause of the spill – Size of area the spill spread to – Was the spill in water or on land – Does the spill have potential to enter a water body – Detail of immediate action taken to control the spill – Additional actions required or ongoing to control the spill – Any restoration required at the spill site – Names of PCA representatives that were present at the spill site

Activity / Concern	Mitigation Measures
Fire	› An emergency fire contingency plan is required for projects where risk of fire exists (e.g. for operations on dry grassland habitats) as requested by PCA in consultation with the Fire Management Officer. › Fires or burning of waste materials is not permitted. › The Prime Contractor is responsible for ensuring that all crew members and sub-consultants on site receive a briefing about the Fire Contingency Plan and are aware of the location of emergency equipment, such as fire extinguishers. › Where an emergency fire contingency plan has been requested, the prime contractor should provide, at minimum the required equipment as defined in the Schedule of the Alberta Forest and Prairie Protection (Ministerial) Regulation (Appendix 1). › The fire contingency plan must at minimum contain the following information: – required equipment on site; – fire prevention procedures; – initial response; – fire reporting procedure; and – up-to-date emergency response contact list.

3.3 Fish and Fish Habitat

Mitigation measures applicable to fish and fish habitat

Activity / Concern	Mitigation Measures
Instream Work	› No instream works below the high-water mark
Maintain Riparian Vegetation	› Maintain a 30 m buffer of undisturbed vegetation between the construction site and Blakiston Creek in areas where design plans (e.g. viewpoints and sections of Crandell Lake trail) do not necessitate disturbance › Access site on existing road system › Avoid riparian vegetation removal (no removal anticipated) › When practical, alter riparian vegetation by hand. If machinery must be used, operate on land and minimize disturbance to the banks of the waterbody.
Carry out works, undertakings and activities on land	› No instream works below the high-water mark › No construction of structures below the high-water mark or structures that may result in erosion and/or scouring of the stream bed › No removal of material from the banks, shoreline, or waterbody bed
Erosion and Sediment Control	› An Erosion and Sediment Control Plan (ESCP) will be prepared that covers all construction and restoration periods. › The requirements for an ESCP can be scaled to the scope and associated risks of the project, as determined by the IAO or SO. › The ESCP will be developed by a qualified professional and is subject to approval of the IAO. › Contractor shall adhere to the ESCP.

	› Install and regularly inspect erosion and sediment control measures (ex. Silt fencing, coir logs). › Ensure all erosion and sediment control devices are weed free. Straw and hay based erosion control products are not permitted. › Avoid use of coconut matting due to potential for ungulate hoof entrapment. › Erosion and sediment control measures shall be in place prior to construction and ground disturbance › Schedule work to avoid extreme wet, windy and rainy periods that may increase erosion and sedimentation. › Avoid soil disturbing activities during periods with saturated soils, periods of runoff, high rainfall intensity, high winds, or wet snow. Temporarily stop work when wet ground conditions contribute to erosion and sediment transport. › Minimize runoff into water bodies; direct runoff and storm water into vegetated areas rather than directly into surface waters › Leave non-active construction sites vegetated
Prevent Entry of Deleterious Substances into Water	› Contractor will adhere to a pre-approved spill containment plan and ensure that emergency spill response equipment is on site during all periods of construction. › During construction, any required cleaning of tools and equipment must be done greater than 30 m from waterbodies to prevent the release of wash water that may contain deleterious substances › Machinery (e.g., excavators, bobcats, chainsaws, generators) must be stored, maintained and refuelled on a flat surface at least 30 m from the HWM. Refueling must take place on a tarp or portable berm, or on compacted ground › Consider using bio-degradable chain oil/vegetable oils in chain saws especially when working within 30 m of a waterbody › Minimize runoff into water bodies; direct runoff and storm water into vegetated areas rather than directly into surface waters

3.4 Wildlife

Mitigation measures applicable to wildlife

Activity / Concern	Mitigation Measures
Timing Windows	› Should additional vegetation clearing be necessary, the nesting period (April 1 to August 31) should be avoided. If activity within the window cannot be avoided consult with PCA staff for development of suitable mitigation (e.g. nest searches).
General Construction	› Contractor will make bear spray, bear spray training, and wildlife awareness training mandatory to all workers on site. › On-site personnel must be made aware of and report any incidental sightings of wildlife immediately to designated PCA staff. › Schedule operations to avoid critical wildlife life stages (breeding, nesting, denning, roosting, rearing, migration). Consult with designated PCA staff to discuss site-specific wildlife concerns. › Should active nests, dens, roosts or calving areas be discovered, stop work and contact designated PCA staff immediately for direction.

	› All PCA designated speed limits apply to construction vehicles. Additional speed restrictions may be required to protect wildlife. › Erection of fences is not permitted without the permission of the IAO due to potential for wildlife movement obstruction. › If wildlife is observed at or near the work site, allow the animal(s) the opportunity to leave the work area and away from areas of potential conflict. › Report any potential wildlife conflict (e.g., aggressive behavior, persistent intrusion), distress or mortality. In the case of aggressive behavior or persistent intrusion, stop work and evacuate the area. › Secure all materials that might attract wildlife (e.g. petroleum products, human food, recyclable food and drink containers and garbage). › Contractors shall keep food in locked area (i.e. truck) when present on site and all food shall be removed from site at the end of each day to limit attractants to bears. › Notify the SO immediately of any dens, litters, nests, carcasses (road kills or other), wildlife encounters, or carnivore (bears, wolves or cougars) observations on or around the worksite. › If potentially dangerous wildlife (e.g., bear, cougar, wolf, deer, sheep) persistently enter the work area or display aggressive behavior, the contractor will immediately stop work, notify 9-1-1 or Banff Dispatch (403-762-1473), and safely evacuate the area. › No feeding, baiting or luring of any wildlife (including bears, small mammals, birds); do not approach or harass wildlife in any way. Notify the SO immediately if wildlife obtain garbage or human food. If wildlife get into attractants that have been intentionally or accidentally left out, individuals or the contractor could be charged under the Canada *National Parks Act* Regulations.
Site Preparation, Access, and Management	› All trenches or ditches left unattended overnight must be fenced or covered to prevent wildlife entrapment or provide appropriate egress for wildlife. › Minimize the time excavations remain open and cover or fence when left unattended to reduce the potential for wildlife injury. › Should active nests, roosts or calving areas be discovered, stop work and contact designated PCA staff immediately for direction.

3.5 Vegetation Clearing and Management

Mitigation measures applicable during vegetation clearing and management

Activity / Concern	Mitigation Measures
Timing	› Should additional vegetation clearing be necessary, the nesting period (April 1 to August 31) should be avoided. If activity within the window cannot be avoided consult with PCA staff for development of suitable mitigation (e.g. nest searches).
Disturbance	› Where possible no soil disturbance should occur outside of the areas necessary to be disturbed due to the high density or rare plants. It is recommended that the work areas be matted with rig matting to protect the rare plants during construction and that where possible construction occur in each location for no more than 14 days or rig mats will have to be moved to allow the plants to grow and replaced.

	› Vegetation removal should be limited to the minimum area required for safe operations during construction or to meet the objectives of the clearing activities (i.e., fire breaks, sight lines etc.). › Minimize full removal and retain vegetation when possible to reduce erosion. › Retain 30 m vegetated buffer around sensitive features; where disturbance is unavoidable < 30 m, the SO must be on site during disturbance activities.
Weed Management	› Manage invasive species in accordance with the Alberta *Weed Control Act* and in accordance with PCA Management Directive 2.4.1, Integrated Pest Management, File C-6261-0 (PCA 1998).

3.6 Soil Stripping and Grading

Mitigation measures applicable during soil stripping and grading

Activity / Concern	Mitigation Measures
Soil Stripping and Handling	› No stripping shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest. › Where possible no soil disturbance should occur outside of the areas necessary to be disturbed due to the high density or rare plants › Soil must be stripped in accordance with the Erosion and Sediment Control Plan (ESCP). Key components for soil stripping are: – Minimize soil movement and handling to protect existing native seed bank – Strip topsoil under dry conditions, whenever possible. – In the event of a work program shutdown during inclement weather (e.g. winter conditions unfavourable for construction, heavy rain events, construction delays, etc.) contingency planning for bared soils or excavated material stockpiles is required. – Soils should be salvaged such that they can be replaced in locations similar to pre-disturbance conditions. – Salvage topsoil at all excavation sites for restoration purposes. – Prevent loss of topsoil through wind or water erosion. – Usually the upper 15 cm of soil, below the sod layer if present, is considered topsoil, where topsoil depths exceed 15 cm then salvage the entire depth of topsoil. – Where depths exceed 15 cm, salvage the upper 15 cm of topsoil separately from the remaining, where the seedbank is filled with desirable native seed material. – The SO may designate separate storage of topsoil zones whereby forest soils are stored separately from grassland soils and weed contaminated soils are separated from clean topsoil. – Implement restoration plan for the disturbed area immediately following completion of construction. – Replace topsoil to all areas immediately following fine grading. – Do not compact topsoil. – Where insufficient topsoil is available, the SO may approve moving soil from different projects or areas of WLNP. Imported soil may be used as a last resort and must be from a supplier that has been inspected and approved by the PCA Vegetation Ecologist. Methods of improving vegetation succession using locally sourced, weed and contaminant free materials are preferred.

Activity / Concern	Mitigation Measures
Soil Storage	› Materials shall be placed at storage sites or on the grade without spillage outside the working limits. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation. › Allow space for separate storage of topsoil and spoil; where space is available, separate stored topsoil from spoil by at least 1 m. Use appropriate material (e.g., geo-textile) to separate soil components where space is limited. › Topsoil from separate ecotypes or areas of the project may not be mixed without approval of the SO. › Topsoil may be stored on hardened surfaces, geo-textile material, in topsoil storage containers or directly on undisturbed vegetation. If storage occurs on vegetation, material recovery by hand may be required. › Topsoil should be stockpiled on the uphill side of the disturbance on sloped terrain and away from any grades, subsoils, spoil material, construction activity and day to day operations. › Construct barricades to prevent losses on steep terrain (>18°, 3:1).
Grading	› Remove excess excavated material from site where it cannot be used for the final grading of the area. Site specific arrangements must be made for disposal locations and procedures of overburden.
Backfilling	› Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation. › To limit over compaction, use equipment which minimizes surface disturbance including low ground pressure tracks/tires, blade shoes and brush rake attachments. › Surplus excavated material may be used to fill depressions around the project site providing topsoil is stripped before filling, with approval from SO. › Workers must inspect trench for trapped wildlife prior to backfilling. If trench has been left open for > 24 hours, SO must be notified and time allowed for the SO to complete additional inspection for trapped wildlife such as salamanders. › Backfilling should allow settling to prevent depressions however, long term roach piles on linear disturbances should be minimal.
Erosion and Sediment Control	› An ESCP will be prepared that covers all construction and restoration periods. – The requirements for an ESCP can be scaled to the scope and associated risks of the project, as determined by the IAO or SO. – The ESCP will be developed by a qualified professional and is subject to approval of the IAO. › Schedule work to avoid extreme wet, windy and rainy periods that may increase erosion and sedimentation. › Avoid soil disturbing activities during periods with saturated soils, periods of runoff, high rainfall intensity, high winds, or wet snow. Temporarily stop work when wet ground conditions contribute to erosion and sediment transport. › Erosion control measures that prevent sediment transport into any waterway, water body or wetland shall be implemented by the contractor. › Identify high risk areas or components of the project including areas with fine-grained soils, sandy deposits, slopes, shallow soils, or adjacent to sensitive features (e.g., riparian areas). › Identify sources of potential runoff (e.g., ditches, slopes) from within the construction site or from upslope areas. Construct and maintain structures to

Activity / Concern	Mitigation Measures
	deflect sources of runoff from entering areas of exposed soils (e.g., diversion ditches, vegetative filter strips). › Acquire necessary erosion and sediment control equipment (i.e., landscaping fabric, sediment fences, coir rolls etc.) and install prior to risk of sediment transport. › Minimize slope lengths and angles, promote surface roughness on slopes, and avoid designs and construction practices that result in smooth, uniform slopes. Incorporate texture and organics into the cover of slopes to reduce soil erodibility. › Ensure all activities are conducted at least 30 m from waterbodies wherever possible. › Minimize extent of vegetation cover removal and grubbing. Clearly mark construction boundaries to prevent accidental damage to vegetation. › Minimize the length of time soils are exposed and complete work in one area before commencing work in another area. › If vegetation clearing is scheduled early due to timing windows, grubbing should be delayed until just prior to construction activities, in order to maintain soil stability. › Initiate replanting of disturbed areas immediately after construction is completed. › Maintain and repair all erosion and sediment control structures in a timely manner. If the design of the control measures is not functioning effectively, they are to be repaired. › The site will be secured against erosion during any periods of construction inactivity or shutdown. › Install all erosion and sediment control devices according to Typical Drawings included in ESCP. Typical Drawings must be on site and available at the request of the SO.

4 References

Parks Canada. 1998. Parks Canada Management Directive 2.4.1, Integrated Pest Management, File C-6261-0. December, 1998.

Parks Canada. 2016. Waterton Lakes National Best Management Practices – Campground and Day Use Area Maintenance and Modification. August 2016.

Parks Canada. 2017a. Waterton Lakes National Park General Project Best Management Practices. Version 2.0. May 2017.

SNC-Lavalin Inc. 2020. Basic Impact Assessment, Parks Canada – Waterton Lakes National Park, Crandell Mountain Campground Reconstruction Project. March 6, 2020.

Attachment 1 – Additional Information

Table A.1 Major Spill Definition

Material	Immediate Notification Requirements	Written Spill Report Requirements
Any deleterious substance that enters a water body of any type (e.g., stream, lake, wetland, drainage, sewer) or poses a threat to human safety (e.g., slippery road, explosive hazard, poisonous gas).	Any Quantity, notify the SO and Banff Dispatch.	Required; Any spill volume
Any substance that is hazardous or toxic to the environment including but not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement, sand blasting agents, paint, solvents and hydrocarbons (e.g., fuel, grease, hydraulic fluid).	<100 L, immediately notify the SO. > 100 L, immediately notify the SO and Banff Dispatch.	At the discretion of the SO. Major Spill if not contained. Required; Major Spill

Table A.2 Adapted Alberta Forest and Prairie Fire Protection (Ministerial) Regulations AR 65/2017, Schedule

Required Equipment for Fire Control	People Employed at the Site of Operations									
	1	***2***	***3***	***4***	***5***	***6-10***	***11-20***	***21-30***	***31-40***	***41+***
Shovels	1	1	2	2	3	5	10	15	20	Same as 31-40 plus increase as required by SO in consultation with the Parks Canada Fire Management Officer.
Back pack with pump	1	1	1	2	3	5	10	15	20	
Axe or Pulaski	1	1	1	1	2	5	10	15	20	
Fire pump	0	0	0	0	0	0	0	1	1	
Fire hose (metres)	0	0	0	0	0	0	0	450 m	450 m	
Power saw	0	0	0	0	0	0	0	1	1	

SNC·LAVALIN

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Appendix G

Pit Run Moisture Content – February 2020

Parkland GEO

SOIL MOISTURE CONTENT WORKSHEET

PROJECT: Crandell Mountain Campground Reconstruction
NUMBER: CA0553 **DATE** 2/13/20

Pail	CONTAINER NUMBER	1	2					
#	Wt. Sample Wet + Tare	581.6 g	573.0 g					
	Wt. Sample Dry + Tare	557.2 g	539.7 g					
	Wt. Water	24.4 g	33.3 g					
Sample Pail	Tare Container	17.0 g	17.0 g					
	Wt. Dry Soil	540.2 g	522.7 g					
	Moisture Content	4.5%	6.4%					

SOIL MOISTURE CONTENT WORKSHEET

PROJECT: Crandell Mountain Campground Reconstruction
NUMBER: CA0553 **DATE** 2/13/20

Parkland GEO

SOIL MOISTURE CONTENT WORKSHEET

PROJECT: Crandell Mountain Campground Reconstruction
NUMBER: CA0553 **DATE** 2/13/20

SOIL MOISTURE CONTENT WORKSHEET

PROJECT: Crandell Mountain Campground Reconstruction
NUMBER: CA0553 **DATE** 2/13/20

BH	CONTAINER NUMBER	1	2	3	4	5	6	7
#	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
1	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH	CONTAINER NUMBER	1	2	3	4	5	6	7
#	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
2	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH	CONTAINER NUMBER	1	2	3	4	5	6	7
#	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
3	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH	CONTAINER NUMBER	1	2	3	4	5	6	7
#	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
4	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH	CONTAINER NUMBER	1	2	3	4	5	6	7
#	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
5	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH	CONTAINER NUMBER	1	2	3	4	5	6	7
#	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
6	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

SOIL MOISTURE CONTENT WORKSHEET

PROJECT: Crandell Mountain Campground Reconstruction
NUMBER: CA0553 **DATE** 2/13/20

BH #	CONTAINER NUMBER	1	2	3	4	5	6	7
	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
7	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH #	CONTAINER NUMBER	1	2	3	4	5	6	7
	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
8	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH #	CONTAINER NUMBER	1	2	3	4	5	6	7
	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
9	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH #	CONTAINER NUMBER	1	2	3	4	5	6	7
	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
10	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH #	CONTAINER NUMBER	1	2	3	4	5	6	7
	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
11	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

BH #	CONTAINER NUMBER	1	2	3	4	5	6	7
	Wt. Sample Wet + Tare							
	Wt. Sample Dry + Tare							
	Wt. Water							
12	Tare Container							
	Wt. Dry Soil							
	Moisture Content							

Appendix H

Pit Run Sieve Analysis – February 2020

SIEVE PARTICLE-SIZE ANALYSIS

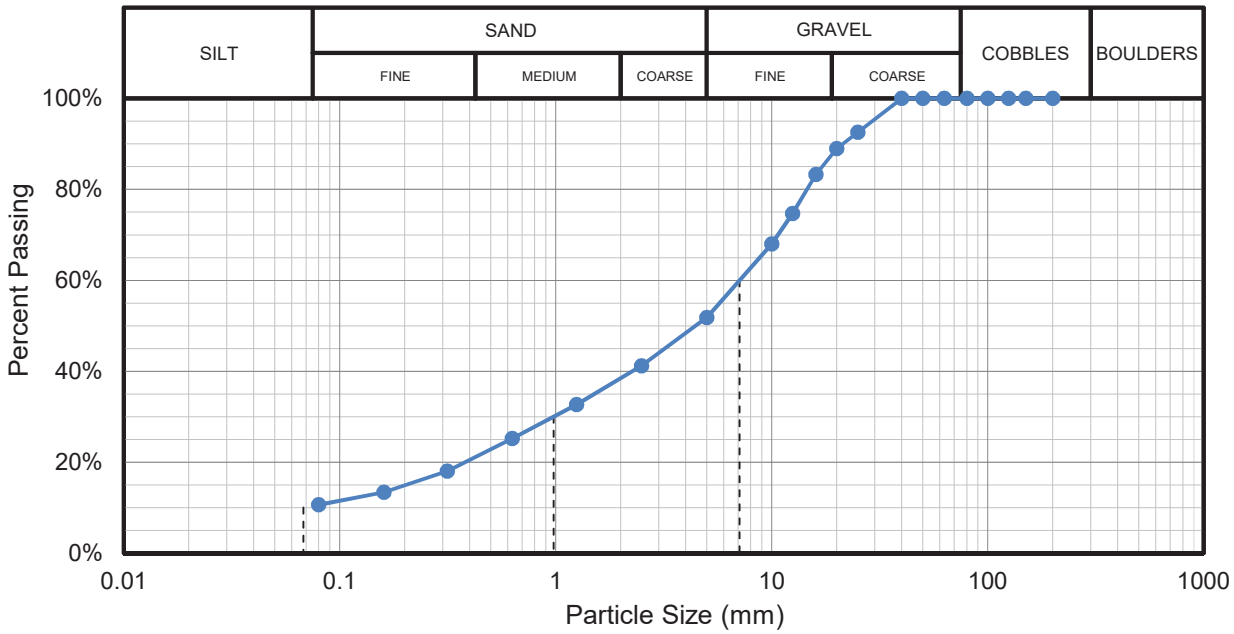
ASTM C136

PROJECT: Crandell Mountain Campground Reconstruction
PROJECT#: CA0553 - CS20-002
CLIENT: McElhanney
SOIL DESCRIPTION: GW-GM - Well-graded gravel with silt and sand

SAMPLED: February 13, 2020
TESTED: February 14, 2020
SAMPLE ID: Pit Run Stockpile - SMS Pit, Red Rock Parkway
DEPTH: N/A

MASS MEASUREMENTS AND PERCENT PASSING

Sieve Size (mm)	Mass Retained on Sieve (g)	Cumulated Mass Retained (g)	Total Mass Finer (g)	Percent Passing
80	0.0	0.0	3718.8	100.0%
63	0.0	0.0	3718.8	100.0%
50	0.0	0.0	3718.8	100.0%
40	0.0	0.0	3718.8	100.0%
25	278.0	278.0	3440.8	92.5%
20	133.1	411.1	3307.7	88.9%
16	210.1	621.2	3097.6	83.3%
12.5	321.6	942.8	2776.0	74.6%
10.0	246.9	1189.7	2529.1	68.0%
5.00	601.2	1790.9	1927.9	51.8%
2.50	396.2	2187.1	1531.7	41.2%
1.25	315.9	2503.0	1215.8	32.7%
0.630	279.1	2782.1	936.7	25.2%
0.315	266.9	3049.0	669.8	18.0%
0.160	173.4	3222.4	496.4	13.3%
0.080	100.9	3323.3	395.5	10.6%
Pan	37.7	3361.0	---	---



RESULTS		
	Gravel	48.2%
	Sand	41.5%
	Silt & Clay	10.4%

GRAIN SIZE		
	D_{10}	0.07 mm
	D_{30}	0.98 mm
	D_{60}	7.09 mm

COEFF.		
	Uniformity, C_U	104.3
	Curvature, C_C	2.0

V15.40 U20190422
J:\CA0550-CA0599\CA0553 - Crandell Mountain Campsite Reconstruction - MTLS\[CS20-002 - Pit Run Stockpile - SMS Pit, Red Rock Pathway.xlsx]Report1

TECH: EA
CHECKED: BH

Appendix I

Waterton Avalanche Safety Plan - 2016

WORKPLACE AVALANCHE SAFETY PLAN

Waterton Lakes National Park

Update January 2016

APPROVAL PAGE

Prepared and recommended by:

_____ _____

Jonas Hoke Date
Visitor Safety Technician
Waterton/Bar-U Field Unit

_____ _____

Ruari MacFarlane Date
Visitor Safety Technician
Waterton/Bar-U Field Unit

Reviewed and approved by:

_____ _____

Dennis Madsen Date
Resource Conservation Manager
Waterton Lakes National Park

_____ _____

Ifan Thomas Date
Field Unit Superintendent
Waterton/Bar-U Field Unit

This plan is valid until January 1, 2021.

Table of Contents

List of Appendices

Section 1 - Introduction

1.1 History and purpose of the avalanche safety plan

In September 2009, an amendment to the WorkSafe BC Occupational Health and Safety Regulation came into effect. This amendment relates to avalanche assessments, and requires that;

1) Before work commences in a workplace where there is or may be a risk from an avalanche to a person working in the workplace, an avalanche risk assessment must be prepared, and;

2) If an avalanche risk assessment identifies an avalanche risk zone, no work may be conducted in the avalanche risk zone at any time when snow conditions have the potential to create an avalanche unless an avalanche safety plan has been developed and implemented.

Parks Canada is governed by federal occupational and health legislation, and is therefore not obliged to comply with provincial provisions. However, this regulation sets a new industry standard, and in 2008 Parks Canada confirmed to WorkSafeBC that it will comply.

The purpose of this Avalanche Safety Plan (ASP) is to describe the avalanche risk faced by Parks Canada's staff in Waterton Lakes National Park, and articulates the plans and programs in place to minimize avalanche risk to all staff.

Parks Canada's goal is to minimize the avalanche risk to workers by first controlling their exposure to avalanche hazards, and next by establishing sound policy and procedures that reduce the risk to those workers who are exposed. All work in avalanche terrain will be defined as essential or non-essential, and rationalized against business objectives.

Parks Canada has been managing avalanche risk for over fifty years, and therefore has many established plans and protocols. Many of these plans are described within this ASP, with liberal use of references and the appendix.

The original 2009 WSBC regulation was again updated in 2015, the most current regulation is listed in Appendix 1 of this document. Amongst other changes, the Qualified Avalanche Planner will no longer be a requirement for implementation and has been eliminated by the Canadian Avalanche Association as a standard of certification. Wording has been updated for clarity in this version of the ASP.

This avalanche safety plan must be reviewed at a minimum, every five years.

1.2 Climate and Geography

Waterton Lakes National Park is 505 square kilometres, located on the east slopes of the Canadian Rockies bordering Glacier National Park (Montana) to the south and the province of BC to the west. The continental divide forms the western boundary of the park.

The snow climate is best described as transitional between continental and maritime influences. This results in a usually denser and more stable snowpack that is found in the Rockies to the north.

Terrain capable of producing snow avalanches is widespread throughout Waterton Lakes National Park. Over 80 larger, well-defined avalanche paths have been identified that have or may affect park and public facilities such as roads, trails, houses and work sites. Snowpack accumulation within the park is highly variable given the influences of frequent strong westerly winds and relatively warm winter temperatures. Greater snowfalls, and subsequent avalanche activity, generally occurs on the western side of the park nearer the continental divide. Upslope storms, with cold air masses pushing in from the prairies to the east, occur several times a winter, producing heavier snow loading on the eastern side of the park and other areas that rarely hold snow.

Avalanche risk generally exists from November 1 to April 30; however, the potential for snow avalanches exists year round at higher elevations.

1.3 Employees, contractors, volunteers and third-party workers

All work undertaken within Waterton Lakes National Park, where workers are exposed to avalanche risk, must be conducted under the authority of an approved ASP.

All employees and volunteers of Parks Canada are considered workers, and without exception, are subject to the conditions of this ASP.

Contractors are responsible for providing their own approved ASP when working on national park lands. In the absence of their own approved ASP, contractors may request to be covered under this ASP, pending written approval from the Visitor Safety Technician.

Other third-party workers (eg: private sector tour-guides) are responsible for providing their own approved ASP when working on national park lands.

Section 2 – Avalanche Risk Analysis

2.1 Infrastructure Exposed to Avalanche Risk

Roads affected by avalanche risk include the Akamina Parkway, Red Rock Parkway and portions of the residential roadways located in the southwest corner of the townsite. These locations are subject to regular snow clearing as required.

The **Akamina Parkway** is maintained to Little Prairie during the winter months (about 14km total length), and crosses one designated avalanche danger zone for a distance of about 300 metres. This zone has a historic avalanche return frequency of about 1 in 10 years based on a few decades of records. The road is also in the potential maximum run-out zone of five other large avalanche paths, although only one has been recorded as reaching the road surface from historical records.

The **Red Rock Parkway** (14 km total length) is also subject to avalanche risk, but is currently closed to public access from November to May. Two avalanche paths have been known to run across the road from historic records. Worker access up this valley is sometimes permitted for specific projects, and will be subject to the procedures established in this plan.

The park **Maintenance Compound** roads and facilities are subject to low-frequency avalanche risk in the northwest corner behind the garage building. Avalanche risk zoning for the Compound and the Waterton Townsite was completed in 1988 by the National Research Council. Affected buildings include the grader shed, garage, emergency generator, and park fuelling station. Park workers may be operating heavy equipment in this area, and at times may be outside on foot. This risk zone has not produced a large destructive avalanche on record, and may be partially mitigated by a rockfall catchment structure in place behind the northerly section of the compound.

The southwest corner of the **Waterton Townsite** is subject to low-frequency avalanche risk from a number of defined avalanche paths on the east flank of Bertha Peak. Portions of public roadways and alleys along Evergreen Avenue are within risk zones, and are plowed during the winter. The park Interpretive Theatre, normally not used during winter months, is also within these zones.

Other work and recreational locations subject to avalanche risk includes most trails and backcountry locations in Waterton. Avalanche terrain ratings using the Avalanche Terrain Exposure Scale (ATES), have been applied to over 40 separate backcountry trips, providing a partial indication of the potential avalanche risk in these areas. ATES ratings can be found in appendix 2. Backcountry cabins located at Lone Lake, Snowshoe and Yarrow are not in avalanche risk zones, although exposure to avalanche terrain is required to access Lone Lake and Snowshoe.

2.2 Workers Exposed to Avalanche Risk

In Waterton, exposure to avalanche risk varies between workgroups and their various functions. All winter staff may be exposed to a minor degree of risk when driving the Akamina Parkway or the Maintenance Compound, or the southwest corner of Waterton Townsite. Existing avalanche safety programs are designed to minimize this risk by closing access to these facilities when appropriate. Some staff will spend considerably more time in avalanche terrain in these areas or in the backcountry, and their duties, and minimum required certifications are as follows:

Highways Maintenance Staff, including Garage Staff;

- Responsible for clearing and maintaining roads, and repairing equipment. Regular exposure to the designated avalanche danger zone on the Akamina Parkway, as well as the maximum runout of several larger avalanche paths. Occasional exposure to low-frequency avalanche paths in the maintenance compound and southwest corner of the Waterton Townsite. Most of this exposure involves travel through the lower runout areas of avalanche paths while conducting snow clearing activities, with little stationary work involved.
- No certifications required.

External Relations and Visitor Experience Staff

- Some ER/VE staff may have an occasional requirement to travel into the backcountry.
- Levels of training and certification will vary, but must meet the requirements of section 5.4.

Resource Conservation – Avalanche Program

- Responsible for weather, snowpack and avalanche monitoring. Duties include travelling on roads open or closed due to avalanche risk, travelling by snowmobile and ski in and across avalanche paths, and conducting snowpack analysis in avalanche start zones. Organized rescue response to reported avalanche accidents is also the responsibility of this program. When conducting these kinds of activities this group is exposed to avalanche risk for significant portions of their work period.
- Specific roles and responsibilities will vary with position duties and functions, although similar avalanche risk exposure is experienced within the group. In general, the Visitor Safety Technician and Avalanche Forecasters are responsible for producing public avalanche bulletins and making decisions regarding road and facility closures, as well as conducting field investigations and leading organized rescue responses. Avalanche Program Technicians will focus on conducting study plot and field investigations, other activities involving avalanche observation and data collection, and participating in organized avalanche rescue responses.

- Certification for Visitor Safety Technician;
    - Canadian Avalanche Association (CAA) level 2 certification, CAA level 3 desirable;
    - CAA professional member in good standing;
    - Advanced first aid.

- Certifications for Forecasters and Rescue Leaders;
    - CAA level 2 certification;
    - CAA professional member in good standing;
    - Advanced first aid.

- Certifications for Avalanche Program Technicians;
    - CAA level 1 certification;
    - Advanced first aid.

Resource Conservation – other staff

- Other Resource Conservation staff may have occasional to regular requirements for winter travel in the backcountry to conduct research, monitoring or other activities. Select individuals with equal or greater certification as Avalanche Program Technicians may be identified for organized avalanche rescue training and response. Exposure to avalanche risk may occur along trails or in other backcountry locations.
- All staff are subject to the terrain travel requirements in section 5.4.
- Certifications;
    - Wilderness first aid;
    - Avalanche Safety Training (AST) level 1 (for staff not identified as organized rescue responders).

Park Wardens

- Park Wardens may have occasional to regular requirements for winter travel in the backcountry to conduct patrols, investigations and other enforcement activities. Exposure to avalanche risk may occur along trails or in other backcountry locations.
- All staff are subject to the terrain travel requirements in section 5.4.
- Certifications:
    - Wilderness first aid;
    - CAA level 1 certification, AST Level 2 certification

Volunteers

Volunteers are subject to the same standards as all other employees listed in this document. If their rationalized duties require travel in avalanche terrain, they are subject to the terrain travel requirements described in section 5.4.

Section 3 – Operational Avalanche Risk Mitigation

3.1 Avalanche Terrain Mapping

Records of avalanche activity in Waterton go back over 60 years, however detailed reporting only began in the early 1970's. Avalanche terrain mapping and zoning for the southwest corner of the townsite and the parks works compound was completed by the National Research Council of Canada in 1988. The Waterton "Natural Hazards Assessment and Evaluation", completed in 1989 provided the first comprehensive mapping of avalanche terrain affecting park facilities and recreation areas. Over 80 larger, well-defined avalanche paths are identified. Subsequent GIS-based mapping has further delineated avalanche path boundaries and more closely defined Avalanche Forecasting Zones.

3.2 Avalanche Hazard Index

The avalanche hazard index (AHI) is used on the avalanche paths that threaten park roads and highways. It is the probability of damage as a result of an interaction between snow avalanches and vehicles on a road. The AHI is a function of:

a) The width and depth of avalanches at the road.
b) The frequency of avalanche occurrences.
c) The number of avalanche paths at the road.
d) The distance between the avalanche paths.
e) The Winter Average Daily Traffic Volume (WADT).
f) The waiting time during an avalanche cycle between the first avalanche to reach the road and the clearance of traffic from the avalanche areas.
g) The speed of the traffic

The **Akamina Parkway** is rated Very Low hazard, scoring about 0.01 on the detailed index, and 0.5 on the simplified index. These numbers compare to the Emerald Lake Road in Yoho, and are indicative of a low likelihood of avalanches involving road traffic over time. No active avalanche control measures such as explosive control or protective structures are warranted.

3.3 Avalanche Terrain Classification using ATES

The Avalanche Terrain Exposure Scale (ATES) is a classification method used for specific trips through avalanche terrain. The system presents three classifications, as shown below, and is a basic first layer avalanche risk assessment.

The classifications are based upon the ATES Technical Model, which presents a more detailed method of avalanche terrain analysis. Waterton Lakes National Park has published terrain ratings for 21 trails/locations in nationally distributed pamphlets and has completed internal ratings of about another 20 trails/locations which are published on the Waterton Lakes website pages. It is important to note the majority of these terrain ratings pertain to travel along well established trails and that travel off of these trails would therefore be considered travel in unrated terrain.

ATES ratings are used in the Employee Policy for Travelling in Avalanche Terrain (section 5.4), and are combined with the avalanche danger ratings to provide a basic measure of daily avalanche risk. Travel protocols and training are based upon this measure.

Description	Class	Terrain Criteria
Simple	1	Exposure to low angle or primarily forested terrain. Some forest openings may involve the runout zones of infrequent avalanches. Many options to reduce or eliminate exposure. No glacier travel.
Challenging	2	Exposure to well defined avalanche paths, starting zones or terrain traps; options exist to reduce or eliminate exposure with careful route finding. Glacier travel is straightforward but crevasse hazards may exist.
Complex	3	Exposure to multiple overlapping avalanche paths or large expanses of steep, open terrain; multiple avalanche starting zones and terrain traps below; minimal options to reduce exposure. Complicated glacier travel with extensive crevasse bands or icefalls.

3.4 Operational Avalanche Hazard and Risk Evaluation

3.4.1 Office Based

Forecasters are responsible for producing public avalanche bulletins, making decisions regarding road and facility closures, as well as conducting field investigations. This normally involves monitoring of snowpack, weather and avalanche occurrences. Forecasters will be on duty or call daily throughout the avalanche season. Waterton will participate in the CAA Infoex exchange, and will also maintain records of weather, avalanche occurrences, snow profiles, and other data pertinent to the program.

3.4.2 Field Based

Technicians will focus on conducting study plot and field investigations, and other activities involving avalanche observation and data collection. A large portion of their time, when assigned to the avalanche program, will involve data collection in the field by travelling on ski or snowmobile. Forecasters will also regularly participate in field data collection.

3.5 Avalanche Closures

In general closures may be implemented when conditions exist that are conducive to larger, destructive avalanches affecting roads or other facilities. Precautionary closures may be considered at any time forecasters are concerned that combinations of weather and snowpack conditions may contribute to dangerous avalanche conditions to park workers or the public.

3.5.1 Implementing a Closure

- Immediate radio notification of Res Con, Highways and other potentially affected staff;
- Closure notice developed and distributed to staff electronically;

- Closure documented on the occurrence reporting system;
- Public notification via the park website, and on the current PAB;
- Specific closure details for designated areas;

Akamina Parkway

- Gate near the townsite closed and locked by Res Con or Highways staff;
- Closure notice prominently posted on the gate

Southwest Corner of Waterton Townsite

- Closure barricades and tape erected across vehicle and trail bridges at Cameron Falls, as well as downstream bridges across Cameron Creek;
- Closure notices prominently posted at all barricades
- All cabins in blocks 30, 31 and 35 swept for winter occupation, any occupants advised of avalanche closure and requirement for evacuation

Park Maintenance Compound

- Closure barricades and tape erected along roads north and south of the garage, allowing access to the fuelling station, but not the existing grader shed
- Garage and maintenance compound staff verbally briefed on the closure.

3.5.2 Monitoring and Lifting a Closure

- Forecasters and technicians will monitor closed areas at least on a daily basis checking for avalanche activity and integrity of the closure signs and barricades;
- Monitoring of closed roads may be done by truck, snowmobile or helicopter dependant on the Forecaster's assessment of potential risk to staff;
- Forecasters will decide when closed areas can safely be opened to public and staff access.

3.6 Explosive Avalanche Control

Waterton will not develop any local capability for explosive control. In extreme events, or where warranted and advised, the Forecaster may request explosive avalanche control assistance from the Banff Field Unit.

3.7 Work Planning, Communication Protocols, and Safety Procedures

Highways Maintenance staff and garage staff will follow the safety procedures for work in avalanche terrain (Appendix 3). Park staff with the requirement for winter travel in avalanche terrain will follow the Employee Policy for Travelling in Avalanche Terrain (Section 5.4), as well as the WLNP Resource Conservation Check-in Procedures (Appendix 4). Forecasters and Avalanche Technicians will adhere to the Safe Work Plan from the Assessment of Avalanche Conditions (Appendix 5).

Section 4 - Avalanche Rescue

4.1 Avalanche Rescue Plans

The avalanche rescue plan (Appendix 7) outlines procedures for organized avalanche response. It includes instructions for Base/Logistics and for the key roles of responders.

4.2 Companion Avalanche Rescue

All staff working in avalanche terrain will have avalanche training that includes companion rescue training. This will also be covered during annual refresher training.

Section 5 – Training, Certification and Equipment Requirements

All staff that expect to enter avalanche terrain will be required to attend annual avalanche orientation training that will address the information in the Avalanche Safety Plan and any updates that have been made. This includes highways staff.

5.1 Annual Refresher Avalanche Safety Training

In addition to orientation training, all staff working in avalanche terrain other than Class 1 Simple Terrain, will also be required to attend avalanche refresher training covering companion rescue. Staff assigned to avalanche rescue response for park visitors will have additional training that covers the latest search and rescue techniques. This training will be documented as it occurs in Appendix 9.

5.1.1 Annual Refresher Avalanche Safety Training for Volunteers and Employees Travelling from another Field Unit

Volunteers intending to work in Waterton Lakes National Park in avalanche terrain other than in Class 1 Simple terrain will preferably attend Annual Refresher Avalanche Safety Training in Waterton Lakes National Park. Employees or volunteers travelling from another Field Unit may have undergone Annual Refresher Avalanche Safety Training at another location. Similarly, qualified volunteers may have received equivalent annual training from another organization (Glacier NP USA, Castle Mt. Resort). In this case, a briefing to inform these people will be conducted before they travel into the field by the Avalanche Forecaster. This briefing will include identification of relevant avalanche terrain along intended routes, current and forecast avalanche conditions, review of local 10- 70 protocols, and an inspection of the avalanche safety equipment that the individuals intend to travel with. The names, qualifications, location and date of Parks Canada Annual Refresher Avalanche Safety Training or equivalent and dates that this briefing was provided to such people will be recorded in Appendix 10.

5.2 Third-Party Training and Certification

Avalanche Safety Training 1 and 2 (AST1, AST2) will be provided by certified instructors either internally or by contractors. Professional level training including CAA Level 1, 2 and 3 and ACMG training will be provided by those respective organizations.

5.3 Avalanche Safety Equipment

All staff working in Challenging or Complex ATES terrain will be required to use avalanche safety equipment. This includes a modern digital beacon compatible with other beacons in the party, shovel and probe.

5.4 Employee Policy for Travelling in Avalanche Terrain

The following standards define what levels of training are required to travel in specific types of avalanche terrain classified with the Avalanche Terrain Exposure Scale. These standards apply to all staff subject to this Avalanche Safety Plan.

5.4.1 Group Leaders

All group leaders must have attended an annual Avalanche Rescue Refresher training. Group leaders must restrict their travel to specific Avalanche Terrain Exposure Scale (ATES) ratings according to their level of avalanche training, and the daily avalanche danger rating at the elevation band they are travelling in. This is described below.

Group Leader Requirements When Traveling in Avalanche Terrain

	ATES Simple Terrain		ATES Challenging Terrain		ATES Complex Terrain		
Level of Training	Low/ Moderate/ Avalanche Danger	Considerable/ High/Extreme Avalanche Danger	Low/ Moderate/ Avalanche Danger	Considerable/ High/Extreme Avalanche Danger	Low/ Moderate Avalanche Danger	Considerable Avalanche Danger	High/ Extreme Avalanche Danger
CAA Professional Member	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed	Requires Forecaster Consult
CAA L1 and demonstration of competence*	Allowed	Allowed	Allowed	Requires Forecaster Consult	Requires Forecaster Consult	Requires Forecaster Consult	Not Allowed
AST 2 or CAA Level 1	Allowed	Requires Forecaster Consult	Requires Forecaster Consult	Not Allowed	Requires Forecaster Consult	Not Allowed	Not Allowed
AST 1	Allowed	Requires Forecaster Consult	Requires Forecaster Consult	Not Allowed	Not Allowed	Not Allowed	Not Allowed

* Resume submitted to the forecaster should include all avalanche related work and ski touring experience. The purpose of the resume is to demonstrate experience, competence, and current skills in managing avalanche risk.

Any travel in terrain unrated by the ATES scale or regions without published avalanche danger ratings requires a forecaster consult. Refer to 5.4.4 for special situations.

5.4.2 Group Members

All staff participating as group members must restrict their travel to specific Avalanche Terrain Exposure Scale (ATES) ratings according to their level of avalanche training, and the daily avalanche danger rating at the elevation band they are travelling in. This is described below:

Group Member Requirements When Traveling in Avalanche Terrain								
	ATES Simple Terrain		ATES Challenging Terrain*		ATES Complex Terrain*			Examples
Level of Training	Low/ Moderate/ Avalanche Danger	Considerable /High/Extreme Avalanche Danger	Low/ Moderate/ Avalanche Danger	Considerable /High/Extreme Avalanche Danger	Low/ Moderate Avalanche Danger	Considerable Avalanche Danger	High/ Extreme Avalanche Danger	
AST 2 or CAA Level 1	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed	Requires Forecaster Consult	Edwin Knox Scott Murphy Sara Jaward Anders Hawkins Dennis Madsen Mike Taylor Barb Johnston Dan Rafla David Musto
AST 1	Allowed	Allowed	Allowed	Allowed	Not Allowed	Not Allowed	Not Allowed	
No Training Required	Allowed	Requires Forecaster Consult	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	

*In *Challenging or Complex* terrain all group members must have attended an annual Avalanche Rescue Refresher training.

5.4.3 Group Requirements

All staff travelling in Challenging or Complex terrain must adhere to the following procedures

- Be equipped with a transceiver, shovel and probe
- Carry a communication device (radio, cell phone or satellite phone)
- Sign out with the duty officer or dispatch (10-70 check-in) prior to entering avalanche terrain.

5.4.4 Special Situations

At times workers may have tasks that require them to work in avalanche terrain that falls outside of this policy. Examples of this may be:

- The intended terrain to be travelled in is not rated by the ATES system.
- The intended terrain to be travelled in falls outside of the avalanche forecast area.
- Staff without the required training need to unexpectedly travel in avalanche terrain. In this case the trip leader must be an ACMG certified mountain or ski guide who will undertake on-site training and risk assessment.

In these cases, a specific avalanche safety plan will be made in consultation with the Visitor Safety Technician. The following information will be required and may take several days to develop.

- What is the intended route and it's ATES rating (if available)?
- Date and time when the work is to occur.
- What level of avalanche safety training do the workers have?

Section 6 – Accident and Near-Miss Investigation and Reporting

6.1 Accidents or incidents involving the public

Incidents with the public will be investigated through interviews and/or with field site investigations. Accidents involving the public will be investigated with onsite field investigation by visitor safety staff.

6.2 Accidents or incidents involving staff

Any avalanche involvement will be investigated by Visitor Safety staff and the Occupational Health and Safety Committee. Any fatality will also include an investigation by a Safety Officer with Labour Canada.

Appendix 1

WorkSafe BC Occupational Health and Safety Regulations Section 4.1.1 and 4.1.2

4.1.1 Avalanche risk assessment and safety plan

(1) In this section and section 4.1.2:

"Avalanche" means snow avalanche;

"Avalanche risk assessment" means the assessment referred to in subsection (2)(a);

"Avalanche safety plan" means the plan referred to in subsection (2)(b);

"Avalanche safety program" means the program referred to in subsection (6).

(2) Subject to section 4.1.2, if a person working at a workplace may be exposed to a risk associated with an avalanche, the employer must ensure that no work is carried out at the workplace until

(a) A written avalanche risk assessment is completed, and

(b) If the avalanche risk assessment indicates that a person working at the workplace will be exposed to a risk associated with an avalanche, a written avalanche safety plan is developed and implemented.

(3) The avalanche risk assessment must be conducted by a qualified person.

(4) In conducting the avalanche risk assessment, the qualified person must consider all of the hazards and risks associated with an avalanche, including, without limitation, the following:

(a) The topography and vegetation in the area of the workplace;

(b) The snow conditions in the area of the workplace;

(c) The history of avalanches in the area of the workplace;

(d) The nature and duration of work activities to be carried out at the workplace;

(e) The extent, if any, to which the nature and duration of work activities to be carried out at the workplace may affect the topography, vegetation or snow conditions in the area of the workplace;

(f) The nature of the workplace and the buildings and structures at the workplace.

(5) The avalanche safety plan must be developed by a qualified person and, subject to subsection (6), must include measures to eliminate the risks associated with an avalanche.

(6) If eliminating the risks associated with an avalanche is not practicable, the avalanche safety plan must include measures and procedures to minimize those risks, including an avalanche safety program that provides for

(a) The regular monitoring of weather, snow and avalanche conditions in the area of the workplace, at intervals the qualified person considers will be effective,

(b) The implementation of closures or other measures, as specified in the avalanche safety program, and

(c) Safe work procedures to be followed by persons working at the workplace.

(7) The employer must make a copy of the avalanche safety program readily available to each person who administers or implements the avalanche safety program for the workplace.

(8) Whenever there is a significant change in the hazards or risks associated with an avalanche in the area of the workplace, the employer must do the following, unless the change is already addressed by the avalanche safety plan:

(a) Ensure that a qualified person reviews the avalanche risk assessment and the avalanche safety plan;

(b) Make changes to the avalanche risk assessment and the avalanche safety plan, as considered necessary by the qualified person, to reflect the current hazards and risks associated with an avalanche in the area of the workplace.

(9) If the avalanche safety plan includes procedures applicable to a person's work at the workplace,

(a) The employer must provide information and training to the person respecting the procedures, and

(b) The person must comply with the procedures.

[Enacted by B.C. Reg. 199/2014, effective February 1, 2015.]

4.1.2 Avalanche risk assessment and safety plan exception

(1) Section 4.1.1 does not apply to work carried out to evaluate whether a person working at the workplace may be exposed to a risk associated with an avalanche.

(2) Section 4.1.1 does not apply if compliance with that section is not practicable when carrying out the following types of work at a workplace where a person may be exposed to a risk associated with an avalanche:

(a) Work that

(i) Is carried out intermittently,

(ii) Involves moving through the workplace without stopping for a significant length of time in a particular area of the workplace, and

(iii) Has minimal potential to trigger an avalanche;

(b) Work related to an emergency;

(c) Work carried out to complete an avalanche risk assessment;

(d) Work carried out to develop an avalanche safety plan.

(3) Before a person carries out work to which subsection (2) applies, the employer must ensure that

(a) Written safe work procedures are in place to minimize the risks associated with an avalanche, and

(b) The person

(i) Understands the risks associated with an avalanche, and

(ii) Is trained in the procedures referred to in paragraph (a) of this subsection.

(4) The safe work procedures required under subsection (3) must be developed by a qualified person and must set out the following:

(a) The qualifications and training a person must have in order to be eligible to carry out work to which subsection (2) applies;

(b) The procedures the person referred to in paragraph (a) of this subsection must follow to identify and address risks associated with an avalanche;

(c) The requirements the person referred to in paragraph (a) of this subsection must comply with when using equipment.

(5) A person carrying out work to which subsection (2) applies must comply with the safe work procedures required under subsection (3).

[Enacted by B.C. Reg. 199/2014, effective February 1, 2015.]

Appendix 2

Avalanche Terrain Exposure Scale Technical Model

	1 - Simple	2 – Challenging	3 - Complex
Slope angle	Angles generally < 30º	***Mostly low angle, isolated slopes >35º***	***Variable with large % >35º***
Slope shape	Uniform	Some convexities	Convoluted
Forest density	Primarily treed with some forest openings	Mixed trees and open terrain	Large expanses of open terrain. Isolated tree bands
Terrain traps	Minimal, some creek slopes or cutbanks	Some depressions, gullies and/or overhead avalanche terrain	***Many depressions, gullies, cliffs, hidden slopes above gullies, cornices***
Avalanche frequency (events:years)	1:30 ≥ size 2	1:1 for < size 2 ***1:3 for ≥ size 2***	1:1 < size 3 ***1:1 ≥ size 3***
Start zone density	Limited open terrain	Some open terrain. Isolated avalanche paths leading to valley bottom	Large expanses of open terrain. Multiple avalanche paths leading to valley bottom
Runout zone characteristics	Solitary, well defined areas, smooth transitions, spread deposits	Abrupt transitions or depressions with deep deposits	Multiple converging runout zones, confined deposition area, steep tracks overhead
Interaction with avalanche paths	Runout zones only	Single path or paths with separation	***Numerous and overlapping paths***
Route options	Numerous, terrain allows multiple choices	A selection of choices of varying exposure, options to avoid avalanche paths	***Limited chances to reduce exposure, avoidance not possible***
Exposure time	None, or limited exposure crossing runouts only	***Isolated exposure to start zones and tracks***	***Frequent exposure to start zones and tracks***
Glaciation	None	***Generally smooth with isolated bands of crevasses***	***Broken or steep sections of crevasses, icefalls or serac exposure***

Using this scale:

Any given piece of mountain terrain may have elements that will fit into multiple classes. Applying a terrain exposure rating involves considering all of the variables described above, with some default priorities.

Terrain that qualifies under an ***italicized*** descriptor automatically defaults into that or a higher terrain class. Non-italicized descriptors carry less weight and will not trigger a default, but must be considered in combination with the other factors.

Avalanche Terrain Exposure Scale - Public Communication Model

Description	Class	Terrain Criteria
Simple	**1**	Exposure to low angle or primarily forested terrain. Some forest openings may involve the runout zones of infrequent avalanches. Many options to reduce or eliminate exposure. No glacier travel.
Challenging	**2**	Exposure to well defined avalanche paths, starting zones or terrain traps; options exist to reduce or eliminate exposure with careful routefinding. Glacier travel is straightforward but crevasse hazards may exist.
Complex	**3**	Exposure to multiple overlapping avalanche paths or large expanses of steep, open terrain; multiple avalanche starting zones and terrain traps below; minimal options to reduce exposure. Complicated glacier travel with extensive crevasse bands or icefalls.

Avalanche Terrain Ratings for Backcountry Touring

Information published in pamphlet as of 2013:

Class 1 – Simple

Akamina Pass
Akamina Pass to Forum Lake
Bear's Hump
Cameron Lake trail (to lake)
Crandel Lake
Dipper
Wishbone

Class 2 – Challenging

Akamina Pass to Wall Lake
Bertha Lake
Forum Lake
Lakeshore
Summit Knob to Cameron Lake
Summit Knob to Boundary Creek
Summit Lake

Class 3 – Complex

Akamina Lake Chutes (The Fingers)
Alderson-Carthew
Lineham Lake (falls)
Rowe Lake (s)
Rowe Bowl / Peak (CV13)

Avalanche Terrain Ratings for Waterfall Ice Climbing

Information available in pamphlets:

Class 2 – Challenging

Compound Gullies
Quick and Dirty
Expert's Choice
Lineham Cliff Waterfall
Sullivan Falls

The following are Terrain Ratings that were completed in 2010. These were not published to the National Parks ATES brochure but are available to the public on the Waterton Lakes National Park website as of November 2012.

Not considered Avalanche Terrain

- Bellvue Prairie Trail
- Blakiston Fan horse trails
- Golf Course trails
- Wishbone trail to Vimy Peak Junction

Simple Class 1

- Akamina Pass
- Akamina Pass to Forum Lake
- Bear's Hump trail
- Cameron Lake Ski Trail to lake only
- Crandell Lake
- Crandell Loop trail along Red Rock Road
- Dipper
- Horseshoe Basin trail – Bison Paddock to Galwey Creek
- Linnet Lake trail
- Park Line trail
- Red Rock Canyon to Goat Lake junction
- Red Rock Parkway (closed in winter)
- Snowshoe Cabin to Castle Divide and Lost Lake
- Yarrow to Oil Basin patrol trail

Challenging Class 2

- Akamina Pass to Wall Lake
- Bertha Lake trail

- Blakiston Valley trail to South Kootenay Pass junction
- Boundary trail
- Cameron Lakeshore trail
- Crandell Loop trail along Cameron Lake Road
- Forum Ridge
- Lakeshore trail
- Goat Lake junction to Snowshoe Cabin
- Horseshoe Basin trail from Trail Creek to Oil Basin
- South Kootenay Pass trail
- South Kootenay Pass junction to Lone Lake
- Snowshoe Cabin to Twin Lakes and Sage Pass
- Summit Lake trail from Cameron Lake
- Summit Knob to Cameron Lake
- Summit Knob to Boundary Creek
- Twin Lakes to South Kootenay Pass junction
- Vimy Peak trail
- Wishbone trail from Vimy Peak junction to Crypt Landing

Complex Class 3

- Akamina Lake Chutes (The Fingers)
- Alderson - Carthew trail
- Bertha Lake Loop trail
- Crypt Lake trail
- Goat Lake trail, including Avion Ridge to Castle Divide
- Lineham Falls
- Rowe Lakes
- Rowe Basin to Lone Lake
- Rowe Bowl / Peak (CV 13)

Appendix 3

Avalanche Safety Procedures for Highway Maintenance Staff, including Garage Staff

Work Completed by Highways Maintenance Staff, including Garage Staff in Avalanche Terrain;

- Normally this group will be operating heavy equipment such as plows and loaders;
- Occasional work may be done outside the protection of vehicles;
- Workers will not normally stop or work outside vehicles in the designated avalanche path on the Akamina Parkway, the identified zones on the Red Rock Parkway, The Compound, or the Waterton Park town site.
- If an avalanche deposit on the road occurs inside the designated avalanche path or near other park facilities or townsite residences, workers will notify the Duty Officer and Avalanche Forecaster. No further action will be taken until an on-site assessment is done by the Avalanche Forecaster. Clearing of roadways may be approved with additional prescribed safety measures, if any, such as the use of spotters or avalanche beacons.
- Opening of closed roads/areas following heavy snowfall and/or avalanche cycles will only be done with the approval of the Avalanche Forecaster if the road was closed due to Avalanche Danger.
- Functioning VHF radios are required in all equipment;
- Access to dispatch or a supervisor is required via radio or phone link;
- Check-in protocols may be required at the discretion of the supervisor.

Appendix 4

Waterton Lakes National Park Resource Conservation

Check In (10-70) Procedures

This is a mechanism that allows workers to set up a safety check in with dispatch prior to starting work that has an element of risk associated with it.
Prior to starting hazardous work contact dispatch and inform them of the following:

- who is in your party
- what your location is
- what you are doing
- what time you would like a check in call

Dispatch will record this information, and call you back at the predetermined check-in time. If you do not respond to the check in call, then dispatch will contact the Public Safety Department and a rescue may be initiated.

**It is important to book off the 10-70 once you have finished the hazardous work.

Appendix 5 Safe Work Plan for Assessing Avalanche Conditions

PARKS CANADA *SAFE WORK PRACTICES*	
Task: **Assessing Avalanche Conditions**	**Work Place:** **Waterton Lakes National Park**
Registration No.:	**Date:** December 5, 2013

Purpose: Safe Work Practices (SWP) relating to Assessing Avalanche Conditions will be used to eliminate, nullify or control hazards in order to prevent staff injuries.

Scope: Forecast avalanche conditions to produce backcountry avalanche bulletins and for safe backcountry travel.

Hazards:

• Slip/trip/fall • Vehicle, Snowmobile, Helicopter (or other means of transportation) accident • Being struck from above • Musculoskeletal Hazards • Equipment malfunctions • Environmental hazards (e.g. onset of darkness, remote location, climatic conditions.)	• Working alone • UV exposure • Hazards associates with equipment failure • Exertion (shovelling, travel over debris) • Restricted communications *Specific to Avalanche Hazards:* • Hazards associated with avalanche involvement (burial, trauma)

Qualifications/Training:

- CAA level 2 as team leader;
- Minimum one CAA level 1 or AST 2 as team member, additional team members must be AST 1 or higher;
- Annual avalanche safety training;
- Wilderness First Aid Training;
- Annual helicopter orientation safety training- if applicable

Personal Protective Equipment (PPE):

- First aid kit
- Protection from the sun: eyewear (sunglasses or goggles)
- Appropriate head protection for helicopter operation
- Snowmobile helmet, ski helmet optional
- Hearing protection- helicopter
- Skin Protection
- Avalanche safety equipment (transceiver, shovel, probe)
- Ski mountaineering equipment and footwear

Other required safety equipment: *Other equipment that is not PPE is to be identified whereby the employee's protection will be enhanced and the hazards reduced.*

- Repair kit
- Bivouac sac / Tarp
- FM radio/ spare battery

- Satellite Phone
- Appropriate clothing protect from extreme temperatures and adverse weather conditions:
- GoreTex® mountain jacket (orange for high visibility)
- Fleece mountain jacket
- Windstopper wind shirt
- Windstopper vest
- Insulated winter mountain jacket (orange for high visibility)
- Summer weight mountaineering pants
- Winter weight mountaineering pants
- GoreTex® mountain overpants.

Safe Work Practices:

DO

- ☑ Ensure you have the ability to contact the duty officer and Banff dispatch
- ☑ Follow 10-70- protocols
- ☑ Assign staff with skiing competence to allow travel in all snow conditions in difficult terrain
- ☑ Access sites with pilots trained in mountain flying and certified as Parks Canada Rescue Pilots
- ☑ Attend annual helicopter safety training.
- ☑ Perform training in terrain assessment and avalanche safety, CAA Level II and mentoring by experienced forecasters to ensure sounds decisions are made in the field
- ☑ Ensure proficiency in all aspects of companion rescue is necessary. This includes competency with safety equipment (beacon, probe, shovel).
- ☑ Learn correct shovelling techniques.
- ☑ Maintain adequate fitness level and core strength. Minimize overexertion- sweating.
- ☑ Study the signs and symptoms of hypothermia, frostbite and cold injuries. Prevent their occurrence and be able to treat (seek warmth, appropriate clothing)
- ☑ Wear protective eyewear to prevent snow blindness
- ☑ Wear protective head protection when working under helicopter or riding snow mobile
- ☑ Wear appropriate clothing that will prevent host loss
- ☑ Inspect clothing regularly for damage, repair or replace if worn or defective and store properly

DO NOT

- ☑ Put your personal safety in jeopardy.
- ☑ Use worn out, damaged equipment- inspect regularly for damage, repair or replace worn or defective and store properly

Additional information:

Canada Labour Code, Part II

Canada Occupational Health and Safety Regulations

Worksafe BC Regulation 4.1.1- specific to workers exposed to avalanche hazard (effective fall 2009)

Appendix 6
Avalanche Rescue Equipment

Located in the rescue room at the Waterton Lakes Warden Office, the following equipment is dedicated to avalanche rescue;

- Steel avalanche probes 15
- Steel shovels 6
- Marker wand kit 1
- Recco receiver 1
- Spare shovels, aluminum probes
- Spare transceivers
- 2 Cascade Toboggans c/w hypothermia kits: sleeping bags and chemical heaters
- Overnight equipment: tents, sleeping bags, thermarests, stoves, food

In addition, a variety of survival, camp, first aid, and patient packaging/transport equipment is available in the rescue room.

Appendix 7

Waterton Avalanche Rescue Procedures

Objective

To provide immediate, avalanche-specific response guidelines for Resource Conservation staff in the event of a reported avalanche accident in Waterton Lakes National Park. Party self-rescue procedures are not part of this protocol.

Organization

- General Incident Command System organizational structures and Waterton Search and Rescue Operating Procedures will apply. Incident Command (IC) will be passed to a person on the current avalanche rescue IC list as soon as possible.

- IC will most likely be at the accident site during initial response. In this case a Plans/Logistics Chief should be designated for initial operation of the Incident Command Post, including functions such supply and dispatch. If necessary, a First Party Leader and team may be organized (First Party Leader and IC may be the same person). A minimum of two trained and equipped personnel are necessary for any field response.

Avalanche Rescue Protocols: Duty Officer, IC, and First Party Leader

Duty Officer

1. The Duty Officer will assume IC and begin immediate call-out.

2. Complete the initial avalanche accident report and hold the reporting person or have them remain available for immediate contact.

3. Incident Command will be passed to a person on the current avalanche rescue IC list as soon as possible.

Incident Commander

1. Ensure the appropriate personnel and equipment are being assembled. Current avalanche rescue resource lists for the park may be consulted. Depending on circumstances, Parks Canada and local avalanche rescue dogs may be requested, along with a helicopter and extra trained personnel. Consider the potential need for explosives and avalanche control at the accident site, and ensure that the First Party leader makes this assessment when on scene.

2. Contact the reporting person or agency, and review information provided in the Avalanche Accident report.

3. Determine response strategies and communicate requirements to the Plans/Logistics Chief. Consider filling other positions in the organization as warranted.

4. Brief personnel, delegate a First Party Leader or assume this position, and assign specific tasks.

5. Ensure effective communications are maintained. Consider the potential need for radio relay links in isolated areas. Ensure a satellite phone is carried with the first party.

6. Determine and request any additional specialized services; avalanche control (helicopter bombing), rescue specialists, RCMP, ambulance, weather forecast.

7. Advise Plans/Logistics Chief of any additional back-up requirements.

8. Designate a field staging area and manager if required.

9. Consider requirements of a potentially-extended operation; camp gear, food, fuel, etc.

10. Request evacuation and medical care for victims appropriate to the circumstances.

11. Ensure accident investigation, fracture line profiles, involvement reports, critical incident stress debriefing, etc. are completed as appropriate.

First Party Leader

1. At the direction of the Incident Commander or as IC, assemble a first response party (minimum of two persons). Emphasize safety and speed of initial response. Consider taking a witness along on initial response.

2. Ensure adequate personal gear is carried by each member;

- touring skis, skins & poles;
- rescue transceiver;
- shovel & probe;
- warm clothing;
- head lamp;
- food & water;
- radio c/w spare battery;
- whistle.

3. Assemble and divide for transport as is appropriate the following team gear from the rescue room;

- marker wand kit;
- 2 heavy-duty shovels;
- sleeping bag, bivy sac & ensolite pad, or cascade: c/w hypothermia bag and kit;
- trauma kit, add extra heat packs;
- oxygen kit (keep warm);
- AED- (keep warm)
- orientation / survival equipment;
- tarp / improvised sled kit
- GPS receiver.

4. Travel to the accident site by the quickest means possible: helicopter, snowmobile, skis. If necessary, mark the route, particularly if travelling at night. Consider use of chemical light wands in orientation / survival kit to mark route.

5. At the accident site;

- Assess the area for further avalanche hazard. Decide on escape route. Post an avalanche guard / spotter if necessary;

- Obtain current information from survivors;

- Conduct a hasty search of the slide visually and with the transceiver;

. - Mark the last seen point of the victim(s);

- Mark where victim's tracks enter avalanche;

- Analyze possible trajectory of victims and spot-probe likely burial spots;

- Look for surface clues. Mark location of items and check if victim is still attached. Search around and downhill of clues;

- Upon completion of thorough surface search and spot-probing of likely burial spots, begin coarse probe line (3-hole per step method) at most likely area of burial;

- Prevent contamination of the avalanche site as an avalanche rescue dog may be enroute to assist. No garbage, peeing, unnecessary gear or snowmobiles allowed on the avalanche. If possible use a staging area downwind of the avalanche area, and well away from any avalanche runout zone.

6. When the victim is located;

- Note presence or absence of air pocket around head;

- Clear the face and chest first;

- Complete primary survey ABCs, check airway/mouth for blockages, start rescue breathing unless breathing spontaneously;

- Extricate completely, considering spinal protection and gentle handling (hypothermia);

- Add insulating materials over and around the body, treat for hypothermia, administer oxygen;

- Complete body survey, and treat further injuries before moving.

Appendix 8

Avalanche Risk Assessment for Waterton Lakes National Park
Completed by the National Research Council in 1988

1. Alpine and Sub-alpine Locations – general

Associated Activities - pleasure driving, bus touring, townsite facilities and activities, park worksite, nordic skiing, ski touring, snowshoeing, ice climbing

Map Reference - Figures 1,2,3

Evaluation - Terrain capable of producing snow avalanches is widespread throughout the alpine and sub-alpine regions of the park. Avalanche slidepaths, as defined by topography and avalanche scrub habitat classification (Kuchar 1973), account for approximately 2.6 per cent of the total park area. Larger, well-defined slidepaths that have or may affect park facilities are shown in Figures 1,2 and 3. Snows are frequent and variable within the park, averaging 479.5 centimetres at Waterton Townsite (Seel et al. 1984) and often greater amounts in areas nearer to the Continental Divide. Snowpack accumulations are normally relatively dense and stable when compared to other areas in the Rockies due to the influence of warm temperatures, high winds and frequent chinooks. Average maximum snowpack depths of approximately 170 centimetres are reached in March at Cameron Lake (W.S. files 4). Heavy snows, often in excess of 60 centimetres in 24 hours, occur during most winters.

Records of avalanche activity on most slidepaths that could affect park facilities have been maintained, with some data gaps, since 1971. Avalanches of size class 4.0 and greater (very large avalanches that could destroy several buildings or up to 4.5 hectares of forest) were recorded 14 times, all occurring during chinook weather conditions. Conditions suitable to produce large, destructive avalanches occur less frequently in Waterton than at other areas in Western Canada (Shearer 1988). They may occur over time, though, and studies of the sizes of avalanches have shown that large, destructive avalanches are much larger than the average observed avalanche, and the mass and speed of them often comes as a surprise.

Weather trends in the 1980's have been generally toward warmer mean winter temperatures and decreasing precipitation. Effects of this trend likely account for decreasing average maximum snowpack depths at Cameron Lake and fewer large avalanches, when compared to records from the 1970's.

No persons have died as a result of being caught in an avalanche in Waterton, although on at least two occasions persons have been caught and partially buried. As well, three incidents where structures were damaged or destroyed by avalanches have occurred.

Hazard Evaluation Rating: 11

2. Akamina Parkway

Associated Activities - pleasure driving, bus touring

Map Reference - Figures 1,2

Evaluation - Very large avalanches reaching or exceeding existing runout zones of slidepaths CV-1 to CV-13 could potentially reach or cross the Akamina Parkway. Only two of these slidepaths, CV-10 and CV-13, have been recorded as doing so. Slidepath CV-10 has avalanched to or across the road on three occasions in the last 25 years (J. Zieffle, pers. comm.; W.S. files 4). Slidepath CV-13 has run as far as the road on one occasion. Both slidepaths have starting zones in snow accumulation zones created by ridges and predominate southwesterly winds. No incidents involving human involvement with avalanches in slidepaths CV-10 and CV-13 have occurred. However, a large avalanche on slidepath CV-8 in the 1910's or 1920's apparently hit a horse pack train (E. Haug, pers. comm.). Several horses were buried and killed, but fortunately the one person buried was dug out alive.

Hazard Evaluation Rating: 12

3. Red Rock Parkway

Associated Activities - pleasure driving, bus touring

Map Reference - Figure 1

Evaluation - Slidepaths BL-1 and BL-2 have been observed to avalanche across the Red Rock Road on at least two occasions. Both slidepaths have relatively short tracks and vertical rises, and are not readily defined by vegetation. The slopes are mostly open and grassy, and have southerly aspects. Throughout much of a typical winter, with predominate southwest winds, these slidepaths will be almost devoid of snowcover. However, avalanches large enough to reach the road have occurred as a result of heavy snowfalls accompanied by northerly or no winds. No incidents of human involvement with avalanches on the Red Rock Road have occurred.

Hazard Evaluation Rating: 11

4. Townsite

Associated Activities - Townsite facilities and activities

Map Reference - Figure 4

Evaluation - The east-facing slope of Bertha Mountain has four defined slidepaths (BW-1 to BW-4) leading toward Waterton Townsite. Runout zones of the slidepaths extend into the southwest portion of the townsite west of Cameron Creek. Avalanche hazard lines, calculated by Shearer (1988), indicate the maximum extent to which avalanches can reasonably be expected to run, on the average, once in 100 to 200 years. The avalanches could damage or destroy wood frame buildings inside the hazard line. As well, an additional line within the hazard line of slidepaths BW-1 and BW-4 indicates the boundary of destructive avalanches which can be expected to occur on average once in about 30 years. Evaluation of the four slidepaths follows;

1) Slidepath BW-1 - The slidepath starting zone is large and is in a snow accumulation area in respect to predominate southwesterly winds. Wide slab avalanches may occur which over-run the present slidepath track boundaries (Shearer 1988). Leaseholder buildings on Block 30 (lots 5-9, 12 and 14) and Block 35 (lots 7-11) may be damaged or destroyed. Presently, full-time winter residents do not occupy any of these cabins. Park structures within the hazard line include toilet building #13 and the Falls Interpretive Theatre. In the event of a very large avalanche, however, the theatre building would likely suffer minimal damage due to its concrete construction and low-roof design.

Two large, destructive avalanches have occurred on this slidepath. A cabin on lots 10 and 11, Block 30 was destroyed in 1951 (F. Goble, pers. comm.). These lots are currently vacant. An avalanche in 1966 damaged a cabin which still stands on lot 12, Block 30 (Tremblay 1967). Both avalanches damaged the garage in lot 9, Block 30 but did not affect the cabin. No human injury resulted from either avalanche.

2) Slidepaths BW-2 and BW-3 - These slidepaths have no distinct starting zones and would likely produce only smaller avalanches. They present no hazard to the buildings on lots 16 and 18, Block 30, and lots 1-3 on Block 31 (Shearer 1988).

3) Slidepath BW-4 - The three starting zones of slidepath BW-4 are all in snow accumulation areas. Three tracks run from the zones converging to form a combined track width of 100 metres near the slidepath base. A decreasing slope above the cabin lots allows avalanches to decelerate, but dense avalanche snow may be deflected towards buildings on lots 4-6, Block 31 by a small creek channel (Shearer 1988). Presently, full-time winter residents do not occupy any of these cabins . Park structures within the hazard line include toilet buildings #9 and #12, and kitchen shelters #6 and #7.

One large, destructive avalanche has occurred on this slidepath. In 1951, cabins on lots 7 and 8, Block 31, were partially destroyed when hit (F. Goble, pers. comm.). No persons were injured as these cabins were apparently unoccupied. They were subsequently removed and the lots left vacant. A garage on lot 6 was also damaged, although the cabin was untouched.

Hazard Evaluation Rating: 12

5. Maintenance Compound

Associated Activities - park worksite

Map Reference - Figure 5

Evaluation - The starting zone of slidepath CR-1 west of the maintenance compound is located on the steep, low-elevation open slopes of Tick Ridge. The slopes are not in a snow accumulation zone and predominate southwesterly winds normally keep them almost devoid of snow cover. However, avalanches have been observed when heavy snowfalls accompanied by northerly or no winds occur (W.S. files 4). None have been of sufficient size to reach the compound fence. The hazard line for destructive avalanches, as calculated by Shearer (1988) would run along the westerly wall of the main garage. The equipment storage shed located closer to the base of the slope is the only park structure falling within the hazard line.

Hazard Evaluation Rating: 11

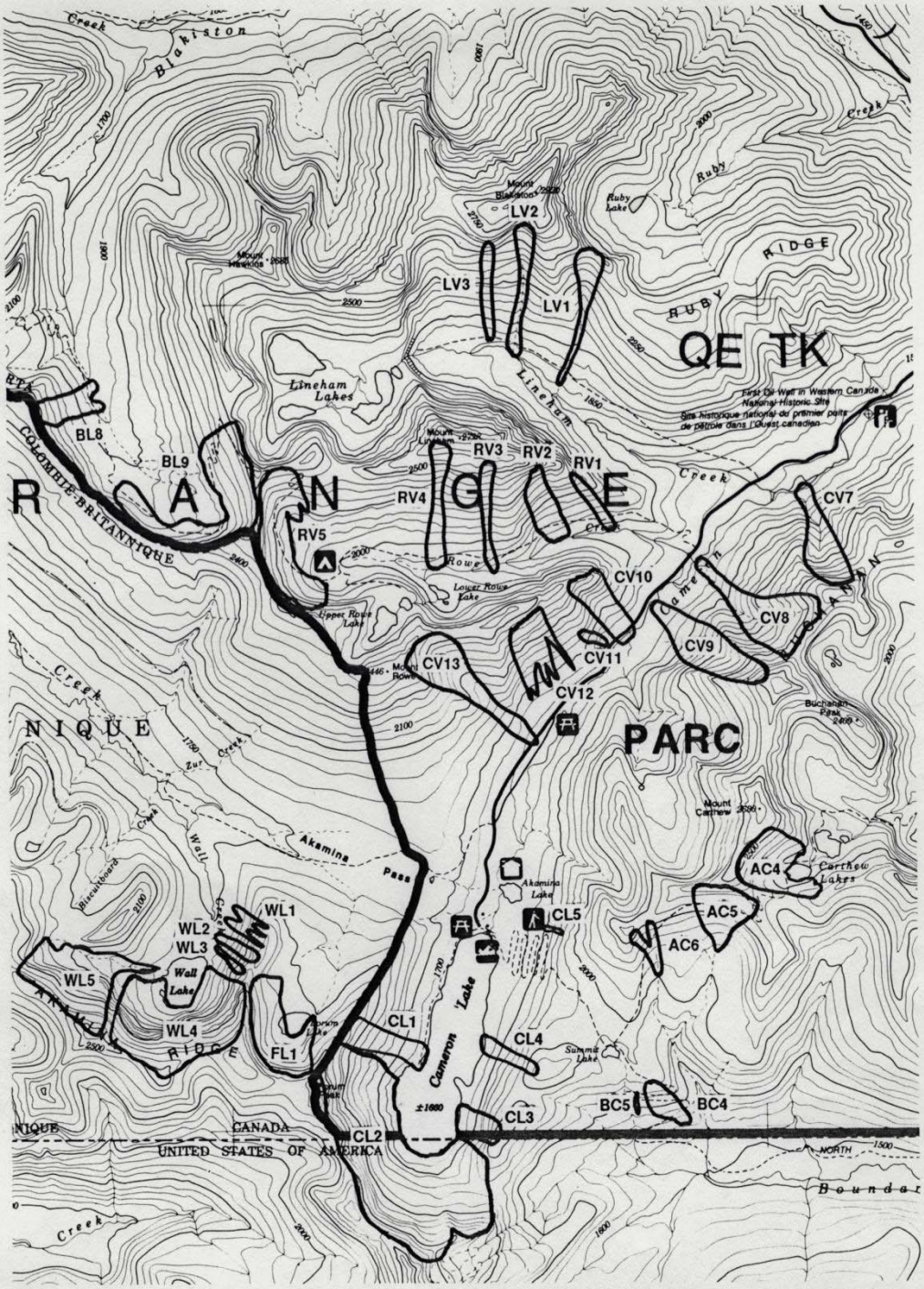


Figure 1. Avalanche slidepaths which may affect park facilities, southwestern area. Waterton Lakes National Park, Alberta. April 1989.

Figure 2. Avalanche slidepaths which may affect park facilities, south central area. Waterton Lakes National Park, Alberta. April 1989.

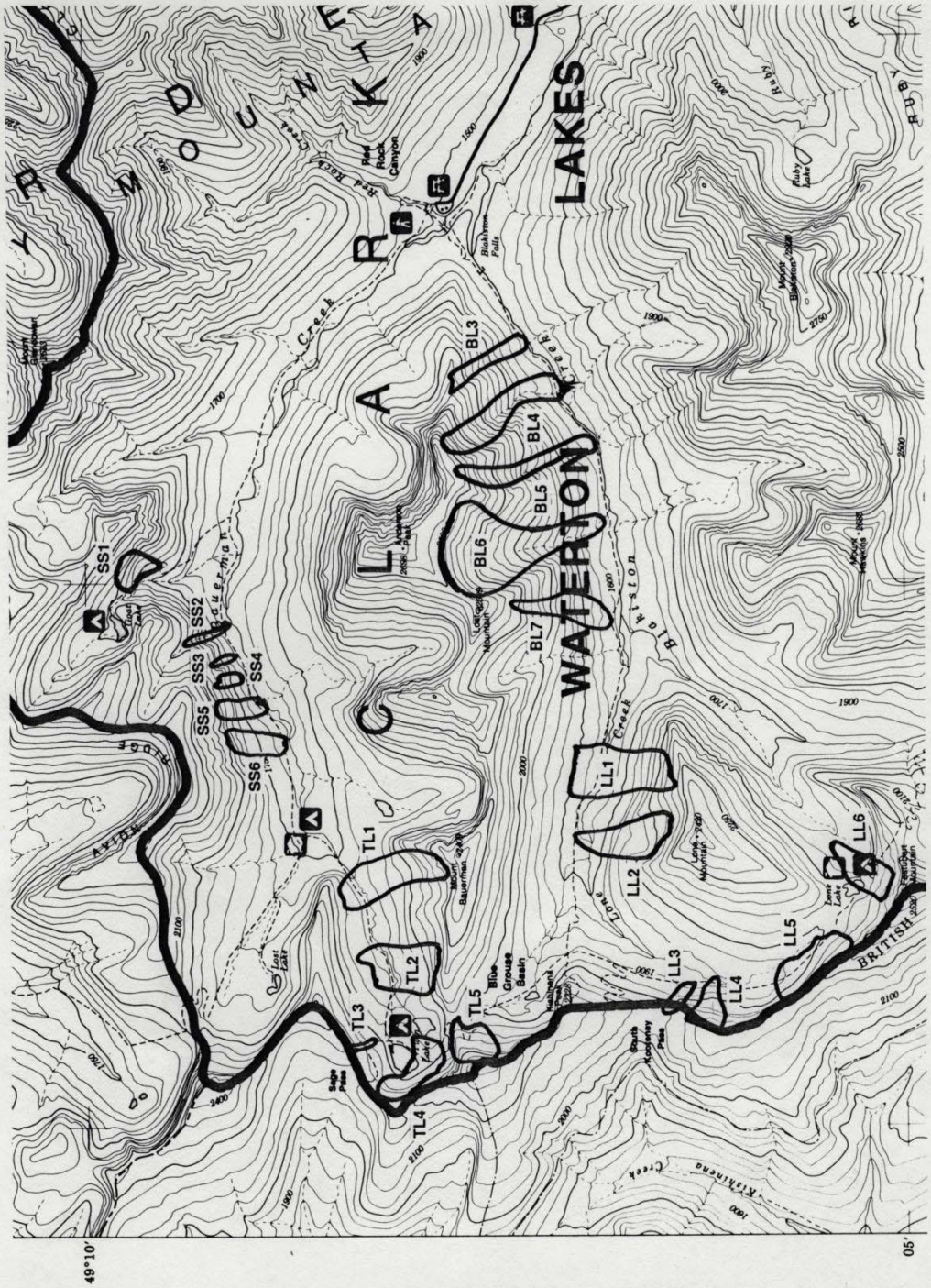


Figure 3. Avalanche slidepaths which may affect park facilities, northwest area. Waterton Lakes National Park, Alberta. April 1989.

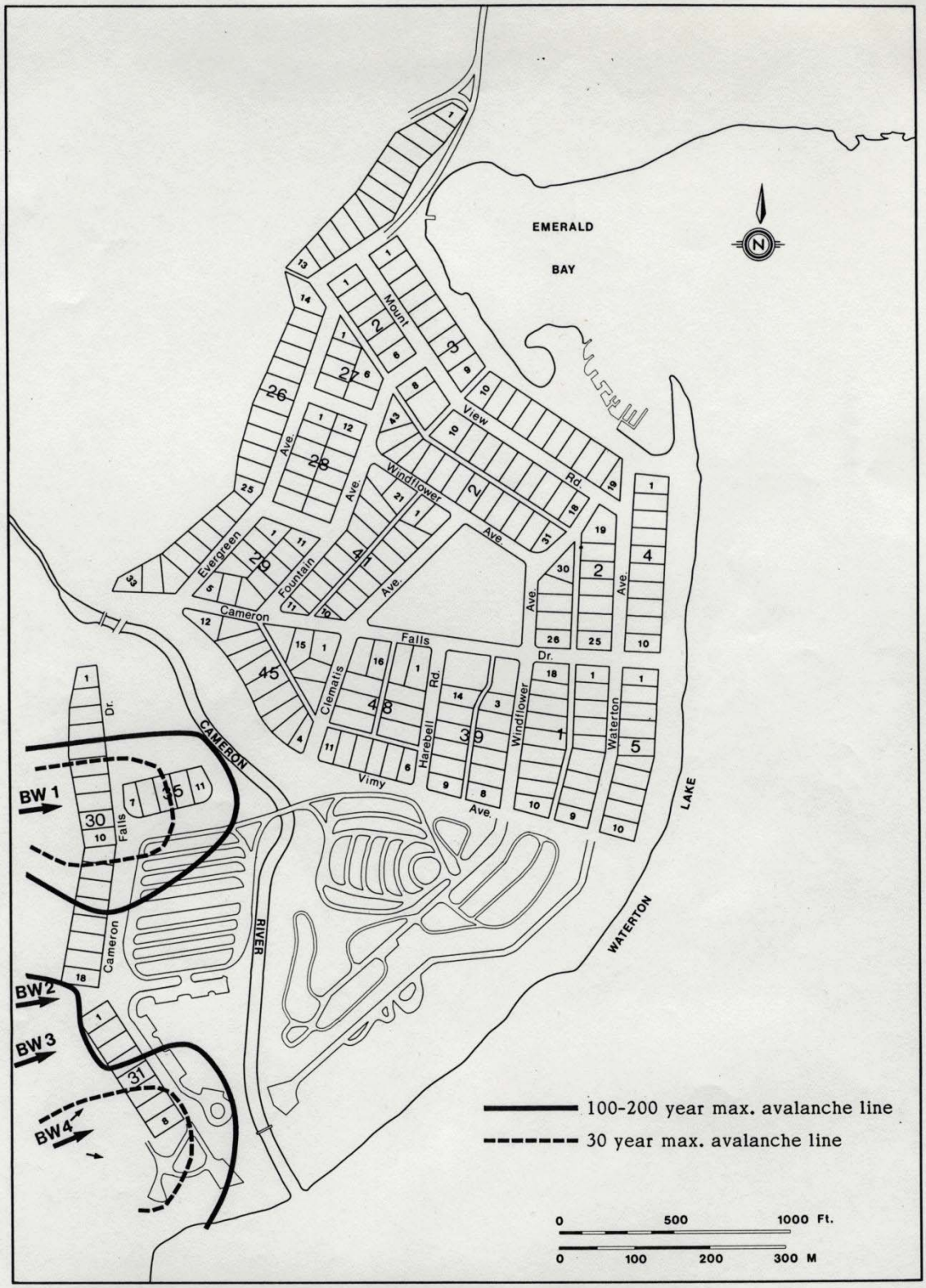


Figure 4: Avalanche hazard lines, southwestern corner of Waterton Townsite, Waterton Lakes National Park (Shearer 1988)

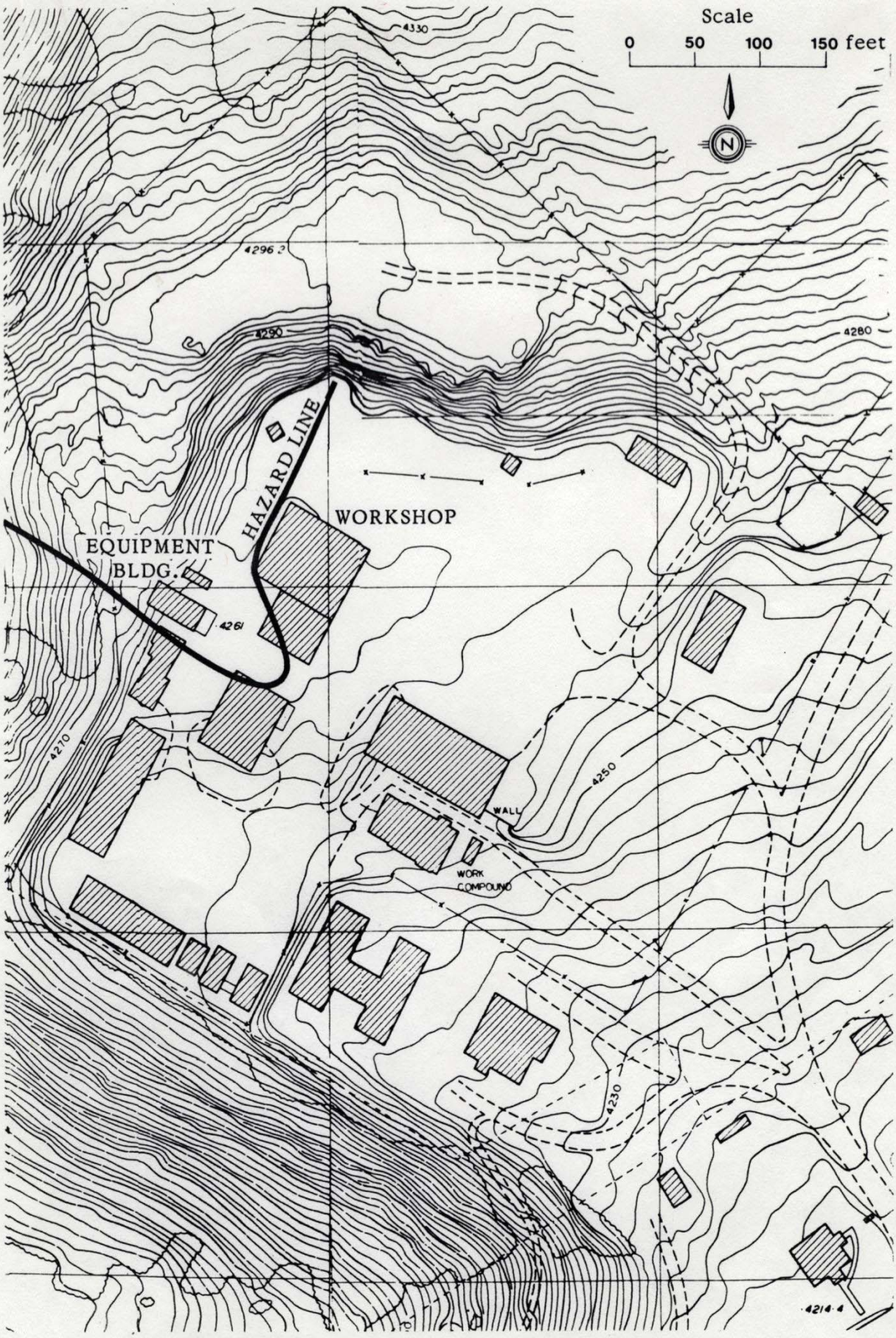


Figure 5: Avalanche hazard line, Park Maintenance Compound, Waterton Lakes

Appendix 9

Avalanche Hazard Zone Mapping for Waterton Townsite and Parks Compound Completed by Alpine Solutions Avalanche Services 2015

Associated Activities - Townsite facilities and activities, and Parks Worksite.

Map Reference - Figure 6, 7

The Guidelines for Snow Avalanche Risk Determination and Mapping in Canada (CAA, 2002) are the generally accepted guidelines for land zoning in avalanche terrain. According to CAA (2002), recommended zones for land use planning include:

1. White Zone – an area with an estimated avalanche return period of greater than 300 years, or impact pressures less than 1 kPa and a return period greater than 30 years.

2. Red Zone – an area where the return period is less than 30 years and/or impact pressures are greater than or equal to 30 kPa, or where the product of impact pressure (kPa) and the reciprocal of the return period (years) exceeds 0.1 for return periods between 30 and 300 years.

3. Blue Zone – an area in between the Red and White Zones, for return periods between 30 and 300 years, the product of impact pressure and frequency is less than 0.1 kPa/years and the impact pressure is greater than or equal to 1 kPa.

Recommended activities according to Zone (CAA, 2002)

White Zone (low hazard) - Construction of new buildings, including permanently occupied structures, normally permitted.

Blue Zone (moderate hazard) - Construction of new buildings such as industrial plants and temporarily occupied structures possibly permitted with specified conditions. Conditions may include structures reinforced for avalanche forces, construction of avalanche defenses, and requirement for evacuation plans (or a combination of these).

Red Zone (high hazard) - Construction of new buildings not normally permitted.

Figure 6 - Townsite

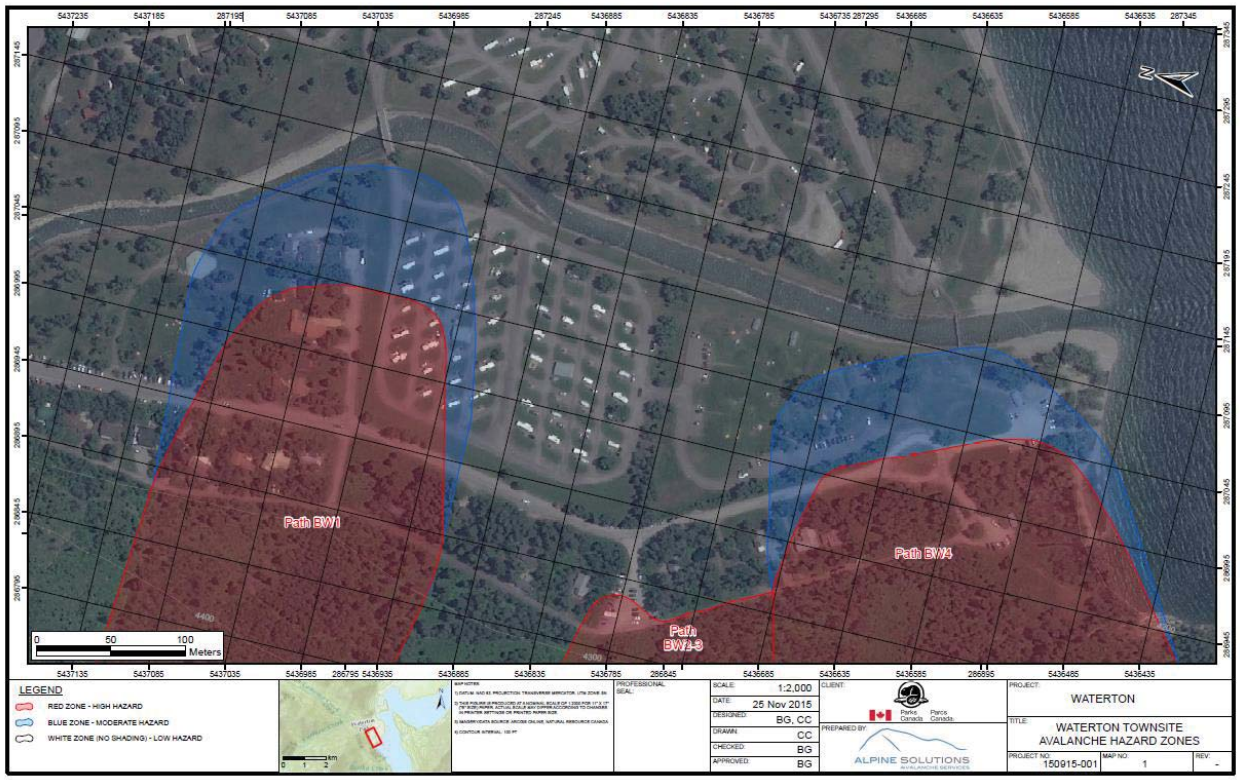
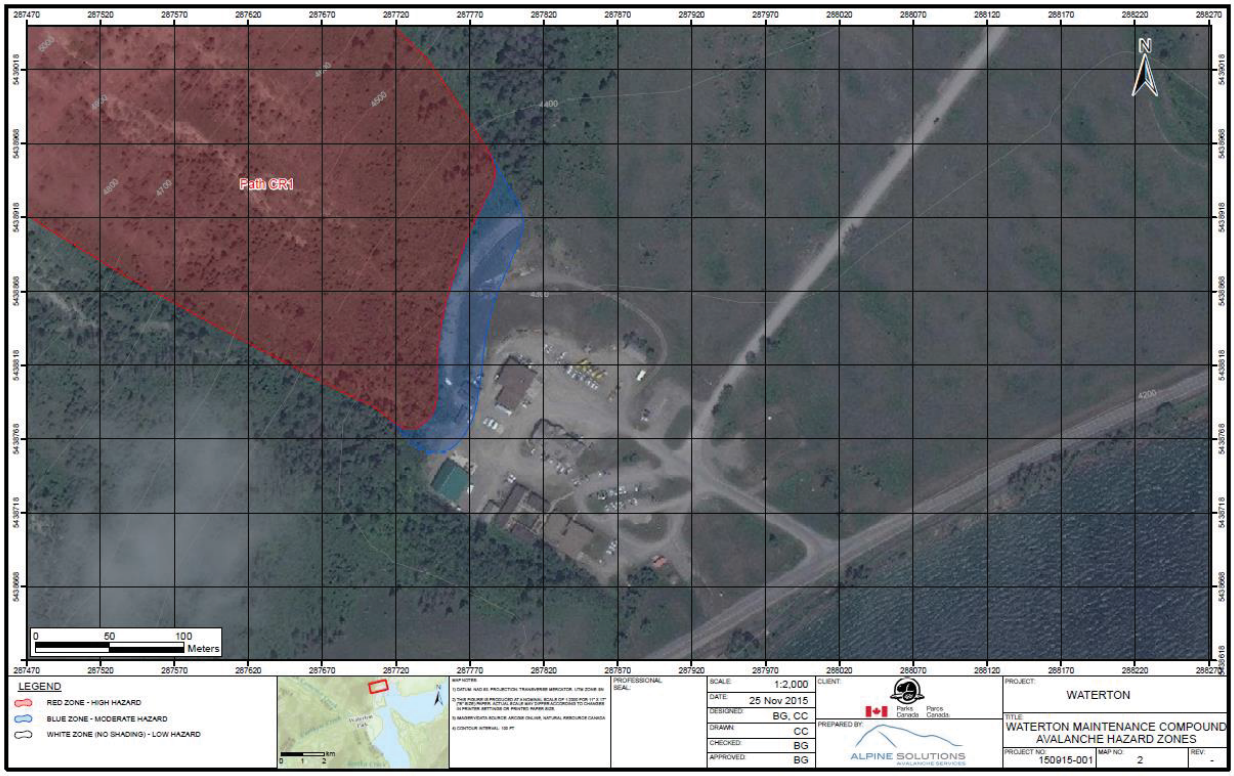
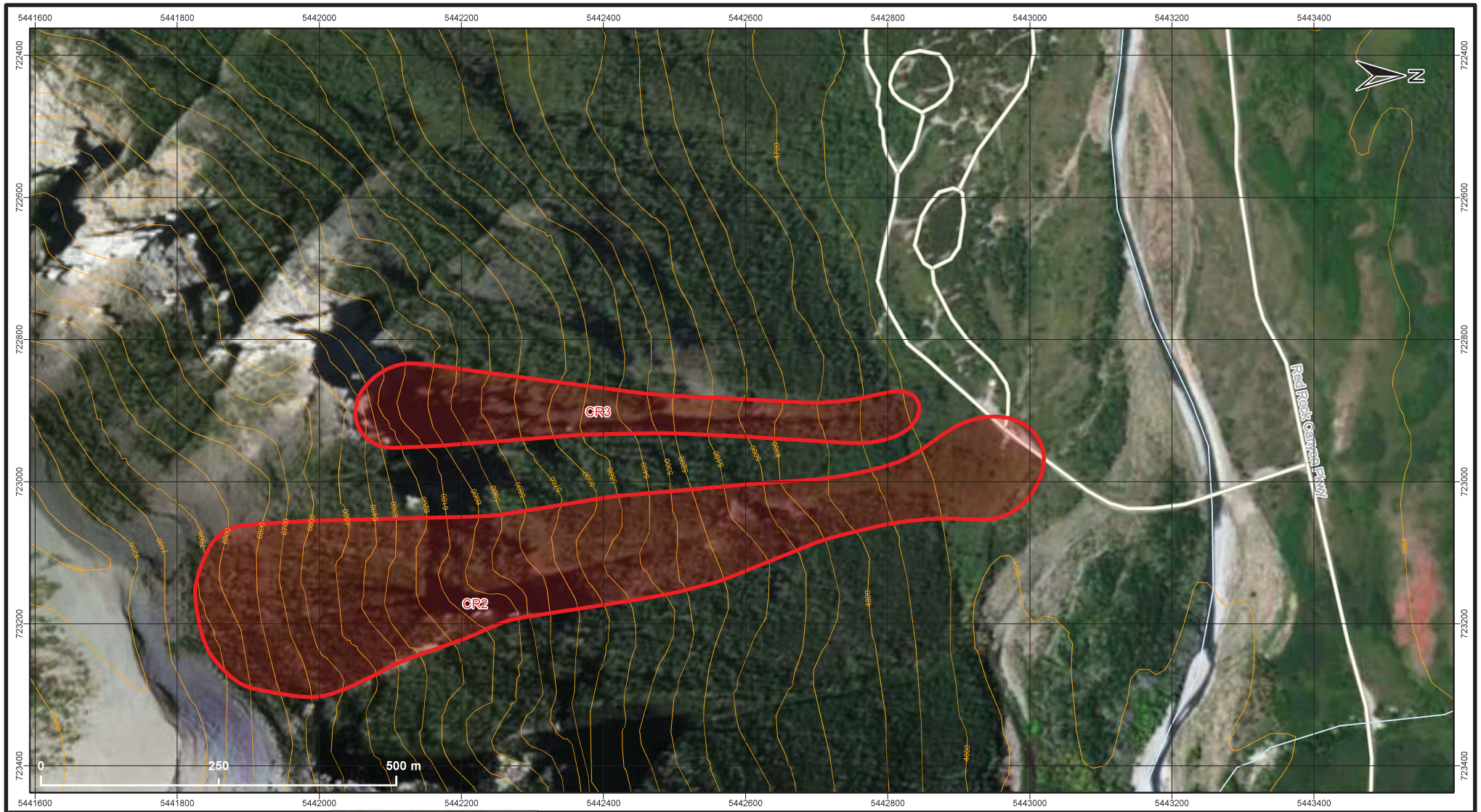


Figure 7 – Parks Maintenance Compound



Appendix J

Waterton Avalanche Path Map - 2018



LEGEND

AVALANCHE PATH

MAP NOTES:

1) DATUM: NAD 83, PROJECTION: TRANSVERSE MERCATOR, UTM ZONE: 11N,
2) THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:5,000 FOR 11" X 17" ("B" SIZE) PAPER, ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.
3) IMAGERY/DATA SOURCE: ARCGIS ONLINE, NATURAL RESOURCE CANADA.
4) CONTOUR INTERVAL: 100 FT.
5) THIS MAP SHOULD ONLY BE READ WITH THE ACCOMPANYING REPORT.
6) RUNOUT ZONE EXTENT MAY HAVE REDUCED ACCURACY DOWNSLOPE OF THE ROAD.
7) PATH BOUNDARIES APPROXIMATE THE 100-YEAR RUNOUT EXTENT AND SHOULD NOT BE INTERPRETED AS THE EXACT BOUNDARY BETWEEN HAZARD AND NO-HAZARD. ANY FACILITIES PLACED NEAR PATH BOUNDARIES SHOULD BE ASSESSED IN GREATER DETAIL.

SCALE:	1:5,000
DATE:	27 Mar 2018
DESIGNED:	BG, CC
DRAWN:	CC
CHECKED:	BG
APPROVED:	BG

CLIENT: Parks Canada Parcs Canada

PREPARED BY: ALPINE SOLUTIONS AVALANCHE SERVICES

PROJECT: WATERTON LAKES NATIONAL PARK

TITLE: CRANDELL CREEK CAMPGROUND AVALANCHE PATH MAP

PROJECT NO:	MAP NO:	REV:
171101-001	3	-