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PARKS CANADA AGENCY

# Technical Specifications for
# Waterton National Park

## Townsite Campground Improvements

**Federal Infrastructure Investment Program – Project #943**

**June 2017**

**No. of Pages**

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## 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 specification

### 1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work under this Contract includes, but is not limited to:

.1 Removal and replacement of site furnishings;

.2 Removal and replacement of concrete pads, sidewalks, pathways and walkways;

.3 Removal and reuse of existing road surfaces;

.4 Topsoil stripping and site grading;

.5 Relocation of Federal Heritage Building (Kitchen #13);

.6 Relocation of non-heritage building (Kitchen #4);

.7 Demolition and removal of one washroom facility (Bathroom #5);

.8 Demolition and removal of one storage building (adjacent to Bathroom #6);

.9 Demolition and removal of one electrical building (adjacent to Bathroom #6);

.10 Decommissioning and replacement of existing electrical network, water and sewer mains, service lines and appurtenances;

.11 Installation of secondary electrical distribution and fixtures;

.12 Tree planting, topsoil placement, seeding and sodding;

.13 Hot mix paving all roads and finishes including pavement markings, wheel stops and barriers;

.14 Installation of traffic signs and campsite ID card signs;

.15 Other associated work as specified herein.

.2 Parks Canada Agency staff will remove and store existing garbage receptacles at the time of construction commencement. Removal of the bins will not be considered the Contractors responsibility. The Contractor will be responsible for removal and replacement of concrete pads and replacement of the Parks supplied garbage receptacles.

.3 Primary electric transmission and transformer installation will be by performed by others. The Contractor will be required to provide site access to the utility company and coordinate with other contractors and/or sub-contractors for the installation of the primary electric infrastructure.

.4 The work covered in this contract is subject to the terms and conditions of the Business Licence, Development Permit and General Project Best Management Practices (V1.0 February 1, 2016) attached herewith.

### 1.3 WORK SCHEDULE

.1 This project shall be constructed in two separate Stages and four Phases in order to limited disturbances to the entire site during limited construction windows. The Contractor shall schedule Work to coincide with the following dates:

.1 Stage A – Includes all Work west of Cameron Creek (Loop B and H)

.1 Phase 1 – September 5, 2017 to October 31, 2017 (or until halted by weather)

.2 Phase 2 – April 3, 2018 to May 17, 2018

.3 No Work shall occur during statutory holiday weekends as per 1.3.2.

.2 Stage B – Includes all Work east of Cameron Creek (Loop A, C, D, E, F, G)

.1 Phase 1 – September 4, 2018 to October 31, 2018 (or until halted by weather)

.2 Phase 2 – April 1, 2019 to May 16, 2019

.3 No Work shall occur during statutory holiday weekends as per 1.3.2.

.3 Tree planting will take place in two periods, being spring 2018 and fall 2018. A test planting of deciduous and coniferous trees as shown on the drawings will take place fall 2017. Completion of all tree planting will be required by spring of 2019 (exclusive of any required replacements).

.2 No construction activities will be permitted during statutory holidays, as follows:

.1 Labour Day 2017 – September 2 to 4

.2 Thanksgiving Day 2017 – October 7 to 9

.3 Victoria Day 2018 – May 19 to 21

.4 Canada Day 2018 – June 30 to July 2

.5 Labour Day 2018 – September 1 to 3

.6 Thanksgiving Day 2018 – October 6 to 8

.7 Easter Day 2019 – April 20 to 21

.8 Victoria Day 2019 – May 18 to 20

.9 Canada Day 2019 – June 29 to July 1

.3 Construction activities are only allowed between 08:00 and 19:00 on weekdays and between 08:00 and 18:00 on weekends.

.4 No additional compensation will be provided to the Contractor for cold weather work or other weather related delays or costs.

## 1.4 WORK SEQUENCE

.1 Contractor shall complete Work in each Stage and obtain the Construction Completion Certificate by the dates noted in Paragraph 1.3. All areas must be inspected by the Departmental Representative for completeness and commissioning for immediate occupancy.

.2 Contractor shall anticipate unstable weather and challenging ground conditions during the proposed construction schedule, which may include but is not limited to frost, snow, ice, water and mud. There shall be no adjustment to the Contract price due to weather and environmental conditions.

.3 Construction activities are prohibited in the Campground during June, July and August without written permission from the Departmental Representative.

.4 Contractor shall not start new construction activities that cannot be completed prior to the aforementioned dates, subject to approval by the Departmental Representative.

.5 Work shall be scheduled and completed in stages to provide continuous and uninterrupted service to other public areas of the campground outside of the current construction

boundary. Public areas and facilities shall not be closed unless an acceptable alternative area, facility and safe access is available.

.6 Stage A must be accessible for public use during Stage B construction and vice versa.

.7 Areas not under construction will remain open and available for public use from May 1 to October 31 of each calendar year. Contractor activities shall not impact operations of these areas without written permission from the Departmental Representative. Phases under construction will be closed to the public after the Labour Day statutory holiday weekend and April 30 of the following year.

.8 All areas disturbed by construction activities, including tracking of material offsite from vehicles, shall be returned to a clean, finished, safe and useable condition, approved by Departmental Representative, prior to the stated end dates.

.9 Contractor shall prepare a detailed schedule outlining major task durations, milestones and completion dates with their bid. Preference will be given to bids demonstrating sequencing and completion within the allotted closure schedule.

.10 The Contractor will be required to provide a detailed project schedule within 1 week of Contract award for the Department Representative approval. When the schedule has been approved by Departmental Representative, take necessary measures to complete Work within scheduled time. Approved schedule shall not change without Departmental Representative's authorization.

## 1.5 CONTRACTOR USE OF PREMISES

.1 Contractor will have full access to the separate Staged areas during construction for the duration of the closures, however, must maintain access for emergency response and fire protection.

.2 Use of site is exclusive and complete for execution of work.

.3 Do not unreasonably encumber site with materials or equipment.

.4 Move stored products or equipment, which interfere with Parks Canada Agency operations or other contractors.

.5 Obtain and pay for use of additional storage or work areas for operations.

.6 Coordinate and cooperate with other contractors or utility crews working on the project.

.7 Contractor is not authorized to camp in Waterton Lakes National Park while the Work is being performed.

.8 Parks Canada Agency regulations prohibit persons working within the Park from using campground facilities, such as bathrooms, shower and kitchen facilities.

## 1.6 NATIONAL PARK REGULATIONS

.1 Contractor and all sub-contractors shall ensure that all Work is performed in accordance with ordinances, laws, rules and regulations set out in the National Park Act.

.2 Contractor and all sub-contractors shall obtain business licenses from Parks Canada Agency Administration Office prior to commencement of the Work.

.3 Contractor and all sub-contractors shall comply with all laws and government regulations applicable to the Work under this contract.

.4 Contractor and all sub-contractors shall comply with mitigation measures and Best Management Practices for environmental issues applicable to the Work under this contract.

.5 All Contractor's and all sub-contractor's business and private vehicles are required to obtain vehicle passes from Parks Canada Agency Administration Office.

.6 Contractor to equip all service vehicles and supervisory vehicles with Emergency Spill Kit DOT-E-10102 or equivalent.

.7 The installation of the electrical facilities associated with FortisAlberta must be carried out by a FortisAlberta approved construction installer as per the requirements listed under the "Customer Installed Pre-Cast Base, Grounding and Ducting Process". A list of approved contractors is available from the ForitsAlberta website at www.fortisalberta.com.

.8 The design of the FortisAlberta Pre-Cast Base, Grounding and Ducting is the responsibility of the contractor. The conduit routing and transformer bases shown on print are for reference only. FortisAlberta will only allow the contractor to complete the installation of these facilities with an approved set of AFC drawings. Only approved FortisAlberta designers may submit plans to FortisAlberta.

.9 Contractor is responsible to ensure all sub-contractors comply with the National Park Regulations in addition to the conditions of Contract.

## 1.7 EXISTING DOCUMENTS

.1 Existing documents appended to this Contract are provided to the Contractor for general information only. Contractor shall make his own reviews, inspections and determinations of the validity of information provided and advise Departmental Representative of any discrepancies with proposed Work.

.2 Appendix A contains Parks Canada Waterton Lakes National Park – Approved General Project Best Management Practices, Feb. 1, 2016. The Contractor shall be familiar with and adhere to the requirements described in the document.

.3 Appendix B contains a Hazardous Material Assessment for the three existing buildings that require demolition and disposal. The Contractor shall perform the Work in accordance with the necessary health, safety and environmental regulations applicable to the materials identified.

.4 Appendix C contains numerous geotechnical assessments within the town and asphalt cores within the campground along with estimated road structure depths. Contractor shall make his own inspections and determination of soil characteristics and estimated pavement quantity removal.

.5 Appendix D contains Waterton Townsite Utilities Inventory, which primarily represents the original water and sewer infrastructure prior to undertaking any upgrades, replacements and improvements. The Contractor shall limit use of this information to within the campground for water and sewer decommissioning work only. These drawings may not represent the current configurations and the Contractor shall make any necessary inspections at his own expense to verify extent of decommissioning Work required.

## 1.8 EXISTING SERVICES

.1 Notify Departmental Representative of and conflicts with new infrastructure and notify utility companies of any interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, provide Departmental Representative at least 72 hours advance notice for any interruptions of services. Minimize duration of interruptions and carry out Work at times and as directed by governing authorities.

.3 Provide alternate routes for pedestrian and vehicular traffic.

.4 Establish location and extent of service lines in area of Work before starting. Notify Departmental Representative of findings.

.5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including water, sewer, power and

communications services or public roadways. Adhere to approved schedule and provide notice to affected parties.

.6 Provide temporary services, when directed by Departmental Representative, to maintain critical systems for any shutdown longer two (2) hours.

.7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.8 Protect, relocate or maintain existing active services. When inactive services are encountered, decommission in a manner approved by authorities having jurisdiction.

.9 Record locations of existing, re-routed and abandoned service lines.

.10 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**1.9 DOCUMENTS REQUIRED**

.1 Maintain at job site, one copy each document as follows:

.1 Construction Drawings.

.2 Technical Specifications.

.3 Addenda.

.4 Reviewed Shop Drawings.

.5 List of Outstanding Shop Drawings.

.6 Change Orders.

.7 Other Modifications to Contract.

.8 Field Test Reports.

.9 Approved Work Schedule.

.10 Health and Safety Plan and Other Safety Related Documents.

.11 Emergency Response Plans.

.12 Environmental Mitigation Documents.

.13 Business Licence and Development Permit

.14 Other documents as specified.

**PART 2. PRODUCTS**

**2.1 NOT USED**

.1 Not used.

**PART 3. EXECUTION**

**3.1 NOT USED**

.1 Not Used.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ACCESS AND EGRESS

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

### 1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of facilities.

.2 Make arrangements with Departmental Representative to facilitate work as stated in this section.

.3 Maintain existing services to facilities and provide all traffic diversion arrangements for safe personnel and vehicle access.

.4 Maintain access through the main entrance kiosk at all times. If complete closure is required due to proximity of construction, Contractor may submit plans for a temporary bypass to Departmental Representative for approval.

.5 Allow access to all areas not under construction.

.6 While working in Stage A, maintain power to Stage B and vice versa.

.7 Maintain throughout construction power and communication connections to the main entrance kiosk.

.8 Any disruptions require 7 days' notice and are limited to no more than 3 hours.

.9 Contractor will arrange sanitary facilities for use by Contractor's personnel and will keep facilities clean at all times.

### 1.3 SPECIAL REQUIREMENTS

.1 Hours of work: As provided in 01 11 00 – Summary of Work.

.2 Submit schedule in accordance with 01 32 16.07 - Construction Progress Schedule

.3 Ensure Contractor's personnel employed on site become familiar with the restrictions and follow Parks Canada Agency regulations including safety, fire, traffic and security regulations.

### 1.4 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted in buildings

## PART 2. PRODUCTS

### 2.1 NOT USED

## PART 3. EXECUTION

### 3.1 NOT USED

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Prime Cost Sum.

.2 Approval Process and Schedule

.3 Measurement procedures.

.4 Cash Allowances

### 1.2 PRIME COST SUM

.1 Include in Contract Price a Prime Cost Sum as provided in the Schedule of Quantities.

.2 The Contract Price, and not Prime Cost Sum, includes Contractor's overhead and profit in connection with such prime cost sum.

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

.4 The use of any part of Prime Cost Sum will be on sole discretion of Departmental Representative and Contractor cannot make any claim if some or the entire Prime Cost Sum amount is deemed unnecessary.

.5 Prime Cost sum items may include but are not limited to:

.1 Special disposal of contaminated soil;

.2 Trench base stabilization;

.3 Additional roadway and concrete repairs;

.4 Additional topsoil placement, landscape planting, and incidental landscape work as direct by Departmental Representative; and

.5 Other Miscellaneous work as directed by the Departmental Representative;

.6 Once a Prime Cost Sum item has been agreed upon with Departmental Representative, it shall be included as an item on the Project Schedule, which will be reflected on the next update of the Project Schedule.

### 1.3 APPROVAL PROCESS AND SCHEDULE

.1 For any additional Work identified by the Departmental Representative, the Contractor will submit a Contract Change Notice (CCN) outlining the Work to be completed, the cost of Work and the impact to the Schedule to the Departmental Representative. No work shall be charged against the Prime Cost Sum without approval in writing from the Departmental Representative.

.2 The substantial completion date for the project will only be renegotiated to reflect the schedule of the Prime Cost Sum item if the Prime Cost Sum item interferes with the critical path of the project.

### 1.4 MEASUREMENT PROCEDURES

.1 Payment for work under the Prime Cost Sum will be made using negotiated rates or the material, labour and equipment rates as per the following:

.1 Rental rates will be in accordance with current Alberta Roadbuilders and Heavy Construction Association rate schedule, and will be all inclusive and fully operated. Hourly rental of equipment will be measured in actual working time and necessary travel time within project limits.

.2 Transportation time to and from site to be reimbursed only if equipment is exclusively used for additional work.

.2 Labour rates and material costs shall be paid in accordance with the General Conditions.

**1.5 CASH ALLOWANCES**

.1 The Contract Price includes a cash allowance with allowances expended for FortisAlberta service agreements and design:

.1 Cash allowances cover the net cost to the Contractor of services where proof of payment must be directed to the Departmental Representative prior to acceptance of payment.

.2 The value of the cash allowance is eligible to be included in progress payments.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED.**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 GENERAL ITEMS

.1 The unit price bid for "**Mobilization & Demobilization; Business License, Insurance, Bonding, Permits, etc; Safety, Health & Environmental Management**" shall be considered full payment for all:

- transportation of materials, equipment and labour forces to and from the jobsite, clean-up and disposal of waste, temporary facilities (site offices, equipment storage, privies, etc.) and final removal of all Contractors items from the site.
- materials and labour required to apply for, obtain, and maintain in good standing any and all bonds, insurance, permits and business licenses in accordance with Federal, Provincial and municipal regulations and laws, including Parks Canada Agency requirements for local permits.
- labour, equipment and materials required to adequately provide protection of workers, public persons and property, wildlife and the environment for the duration of the contract until full revegetation and expiry of the warranty period. Environmental management must meet the requirements stated in Parks Canada Waterton Lakes National Park Approved General Project Best Management Practices. Erosion and sediment control is incidental to the Work being performed.

.1 Measurement will be made in lump sum quantity.

.2 Payment will be made based on Stages of development.

### 1.2 REMOVALS

.1 The unit price bid for "**Remove and Replace Sign**" shall be considered full compensation for all materials, labour and equipment required for the removal and reinstallation of signs, including: removing, loading, hauling, handling, safeguarding, transporting, backfilling, compacting, installing, shaping, associated clean up and all items incidental to complete the work.

.1 Each reinstalled sign will be counted.

.2 Payment will be made for each relocated sign.

.2 The unit price bid for "**Remove and Dispose of Existing Concrete Surfaces**" shall be considered full compensation for all materials, labour and equipment required for the removal of existing concrete surfaces, such as campsite activity pads, sidewalks and building pads, including: cutting, jackhammering, excavating, breaking, demolishing, loading, hauling, disposal of waste material outside Waterton Park, cleaning, and all work incidental to the removal of concrete.

.1 Each surface will be measured individually in neat horizontal lines to the nearest square metre.

.2 Payment will be made for each square metre of concrete removed and disposed.

.3 The unit price bid for "**Remove and Reinstall Existing Timber Roadside Bollards**" shall be considered full compensation for all materials, labour and equipment required for the removal, salvage, and reinstallation of existing timber bollards, including: removal, safeguarding, loading, hauling, storing, reinstallation, associated clean up and all items incidental to complete the work.

.1 Measurement will be for each reinstalled bollard.

.2 Payment will be made for each reinstalled bollard.

.4 The unit price bid for "**Remove and Reinstall Existing Timber Guardrail**" shall be considered full compensation for all materials, labour and equipment required for the removal, salvage, and reinstallation of existing timber guardrails, including: removal, safeguarding, loading, hauling, storing, reinstallation, associated clean up and all items incidental to complete the work.

.1 Guardrail will be measured horizontally, along the top of the rail, from endpoint to endpoint.

.2 Payment will be made for each field measured lineal metre of guardrail installed.

.5 The unit price bid for "**Cold Milling Asphalt Pavement**" shall be considered full compensation for all materials, labour and equipment required for removing all asphalt and chip seal as shown on the drawings up to a depth of 150 mm, including: removing, breaking, crushing or milling to 25 mm minus for use as bedding material, loading, hauling, stockpile at the Red Rock SMS site (~ 6 km haul), associated clean-up and all work incidental to asphalt milling.

.1 All milling work will be measured by survey in square metres for up to 150 mm depths, and prorated on depths beyond 150 mm with prior approval from Departmental Representative.

.2 Payment will be made for asphalt milling by each square metre removed.

.3 There shall be no separate payment for saw cutting existing pavement structures at construction boundary interfaces. Saw cutting shall be performed at all new pavement connections to existing pavement structures and the cost shall be incidental to the Work.

.6 The unit price bid for "**Remove and Reinstall Fence**" shall be considered full compensation for all materials, labour and equipment required for the removal, salvage, and reinstallation of an existing fence in Loop E, including: removal, safeguarding, loading, hauling, storing, reinstallation, associated clean up and all items incidental to complete the work.

.1 Measurement will be taken along the centreline of reinstalled fence.

.2 Payment will be made for each lineal meter of reinstalled fence.

## 1.3 EARTHWORKS

.1 The unit price bid for "**Strip and Stockpile Topsoil**" shall be considered full compensation for all materials, labour and equipment required to strip the existing top layer of vegetation and topsoil to full depth of existing topsoil (150 mm depth for tender purposes) for areas indicated on plans including: stripping, hauling, screening for large rocks (50mm+), curtailing stripped vegetation into 50 mm pieces, stockpiling and stockpile management, associated clean up and all items incidental to complete the Work.

.1 Each area stripped of topsoil shall be surveyed to capture actual in-place area measured in square metres.

.2 Payment will be made for each square metre of area topsoil stripped.

.2 The unit price bid for "**Common excavation**" shall consider the following:

.1 Excavated materials to be measured for payment in cubic metres in their original position. Measurements will be computed from elevations taken before construction commences and after work has been completed. Elevations will be taken by the Departmental Representative and computations for quantities will be made using the end area method.

.2 Payment for common excavation including roadway embankment shall be considered full payment for excavation, hauling, excavation of unsuitable subgrade, watering and dewatering, placing and compaction to specified density, disposal of excess material to waste, re-gravelling of adjacent structures disturbed by construction, stockpiling of all boulders not allowed as backfill and all other work required for which separate payment is not indicated in the bid form.

.3 The unit price bid for "**Imported Fill**" shall be considered full compensation for securing a borrow location, supply, hauling, watering, aerating/drying, placing and compacting the material as specified.

.1 Imported fill to be measured for payment in cubic metres after placement. Measurements will be computed from elevations taken before placing fill and after work has been completed. Elevations will be taken by the Departmental Representative and computations for quantities will be made using the end area method.

.2 Payment will be made for each cubic metre of imported materail placed.

## 1.4 WATERWORKS

.1 The unit price bid for "**100 mm Dia PVC DR 18 Pipe**" and "**150 mm Dia PVC DR 18 Pipe**" shall be considered full compensation for all materials, labour and equipment required for the installation of water line including: temporary water services, supply and delivery of pipe, excavation and trenching to the required depth, supply and placement of granular bedding material, pipe installation to the specified line and grade, fittings, connections, tracer wire, thrust blocks, mechanical thrust protection, bends, reducers, tees, couplings, plugs, backfilling to roadway subgrade elevation, compaction, soil conditioning, dewatering, care of water, disposal of excess material off site, pressure testing, flushing, chlorination, dechlorination and all other work necessary to complete the Work to the satisfaction of the Departmental Representative.

.1 Pipe will be measured horizontally, along the top of the pipe, from centreline of connection to centreline of connection.

.2 Payment will be made for each field measured lineal metre of pipe installed, pending approval of pressure and bacterial testing results.

.3 Decommissioning and removal of existing watermains, service lines, valves, fire hydrants and any other existing appertenance of any size encountered during trenching and construction operations is incidental to this Work and a separate payment for decommissioning as specified willl not be made.

.2 The unit price bid for "**100 mm Dia Gate Valve**" and "**150 mm Dia Gate Valve**" shall be considered full compensation for the supply of all materials, labour and equipment required for the installation of gate valves including: supply of valves, supports, operating rods, valve boxes, cathodic protection, excavation and trenching to the required depth, supply and placement of granular bedding material, valve insertion to the specified line and grade, connections, thrust and anchor blocks, mechanical thrust protection, backfilling to plan subgrade, compaction, soil conditioning, dewatering, care of water, testing, flushing, chlorination, dechlorination and all work incidental to the completed valve installation.

.1 Each valve will be counted.

.2 Payment will be made for each valve supplied and installed.

.3 The unit price bid for "**Fire Hydrant c/w Valve, Lead and Tee**" shall be considered full compensation for the supply of all materials, labour and equipment required for the installation of fire hydrants including: supply and delivery of hydrants, excavating and trenching to the required depth, supply and placement of granular bedding material,

washed gravel sump, hydrant installation to the specified line and grade, connections, thrust blocking, mechanical thrust protections, cathodic protection, supply and install of mainline tee, PVC lead, tee and hydrant isolation valve, backfilling to subgrade elevation, compaction, soil conditioning, dewatering, care of water, testing, flushing, chlorinating, dechlorinating, disposal of excess material off site, and all work incidental to the completed hydrant installation.

.1 Each hydrant will be counted.

.2 Payment will be made for each hydrant installed.

.4 The unit price bid for "**Water Service Standpipe**" shall be considered full compensation for the supply of all materials, labour and equipment required for the installation of the campsite water service lines as shown on the drawings and/or location determined by the Departmental Representative including: supply and delivery of materials, excavating and trenching to the required depth, supply and placement of granular bedding material, standpipe installation to the specified line and grade, corporation stop at the water main, self-draining curb stop, post, concrete, supply and install dual hose bibs as detailed, backfilling, compaction, soil conditioning, dewatering, care of water, testing, flushing, chlorination, dechlorination and all work incidental to the service line.

.1 Each standpipe will be counted as a campsite water service line.

.2 Payment will be made for each campsite water service line installed.

.3 Decommissioning and removal of existing watermains, service lines, standpipes, splash pads, valves and any other existing appertenance of any size encountered during trenching and construction operations is incidental to this Work and a separate payment for decommissioning as specified willl not be made.

.5 The unit price bid for "**Building Water Service Connection**" shall be considered full compensation for the supply of all materials, labour and equipment required for the installation of the building water service lines as shown on the drawings and/or location determined by the onsite Departmental Representative including: supply and delivery of materials, excavating and trenching to the required depth, supply and placement of granular bedding material, saddle connection to water main, connections, mechanical thrust protection, cathodic protection, supply and install curb stop and service lead, tie in to existing building service, backfilling, compaction, soil conditioning, dewatering, care of water, testing, flushing, chlorination, dechlorination and all work incidental to the service line installation.

.1 Each building water service line will be counted.

.2 Payment will be made for each water service line installed.

.3 Decommissioning and removal of existing watermains, service lines, valves and any other existing appertenance of any size encountered during trenching and construction operations is incidental to this Work and a separate payment for decommissioning as specified willl not be made.

.6 The unit price bid for "**Irrigation Valve Box and Standpipe**" shall be considered full compensation for the supply of all materials, labour and equipment required for the installation of standpipes as shown on the drawings and/or location determined by the Departmental Representative including: supply and delivery of materials, excavating and trenching to the required depth, removal and disposal of existing wooden enclosure, supply and placement of granular bedding material, standpipe installation to the specified line and grade, coupling connection to existing supply main, connections, mechanical thrust protection, cathodic protection, supply and install tee with dual hose bibs and mounting post, supply and install irrigation box as per City of Lethbridge standard or as approved by Departmental Representative, backfilling, compaction, soil conditioning, dewatering, care of water, topsoil restoration and seeding or sodding as

appropriate per drawings, and all work incidental to the completed irrigation valve box and standpipe installation.

.1 Each Irrigation valve box and standdpipe will be counted.

.2 Payment will be made for each Irrigation valve box and Standpipe installed.

.3 Decommissioning and removal of existing watermains, service lines, valves, irrigations boxes and any other existing appertenance of any size encountered during trenching and construction operations is incidental to this Work and a separate payment for decommissioning as specified willl not be made.

.7 The unit price bid for "**Drain Manhole**" shall be considered full compensation for the supply off all materials, labour and equipment required for the installation of the drain manhole as detailed in the construction drawings, including: supply and delivery of manhole materials, excavating and trenching to the required depth, supply and placement of granular bedding material, chamber installation to the specified line and grade, connections, thrust blocking, mechanical thrust protection, cathodic protection, mainline tee or saddle, supply and install mainline lead, drain isolation valve, backfilling to subgrade elevation, compaction, soil conditioning, dewatering, care of water, testing, flushing, chlorinating, dechlorinating, disposal of excess material off site, and all work incidental to the completed drain valve chamber installation.

.1 Each Drain Valve Chamber will be counted.

.2 Payment will be made for each Drain Valve Chamber installed.

.8 The unit price bid for "**Connect to Existing Water System**" shall be considered full compensation for all materials, labour and equipment required to connect new water lines to existing water lines of all sizes including: utility locates, excavation, trenching, placing, backfilling to subgrade elevation, compacting, thrust blocks, mechanical restraints, couplers, disposal of excess material off site, coordination and notification required for water service interruption, flushing, testing, chlorination, de-chlorination and all work incidental to the completed tie-in.

.1 Each tie-in location will be counted as one.

.2 Payment will be made for each completed connection to an existing water line.

## 1.5 SANITARY SEWER WORKS

.1 The unit price bid for "**Type 1 Manhole**" shall be considered full compensation for all materials, labour and equipment required for the installation of precast concrete Type 1 manholes in accordance with City of Lethbridge specifications and to the depths and alignments detailed on the drawings, including: excavation, disposal of excess material offsite, supply and install granular bedding material, manhole base, barrel, slab top, collars, frame & cover, grouting, all pipe tie-ins to manholes, backfilling, associated clean-up and all items incidental to complete the work

.1 Each new manhole installed will be measured vertically in metres from lowest pipe invert to the cover rim.

.2 Payment will be made for total vertical metres of manhole installed.

.2 The unit price bid for "**200 mm Dia PVC SDR 35 Pipe**" shall be considered full compensation for all materials, labour and equipment required for the installation of sanitary sewer line including: confirmation of existing tie-in inverts, supplying, loading, hauling, unloading of pipe, trenching to the required depth, supply and placement of granular bedding material, pipe installation to the specified line and grade, backfilling to roadway subgrade elevation, trench compaction, disposal of excess material offsite, connection to manholes, flushing, cleaning, CCTV inspection, and all work incidental to the completed installation of sanitary sewer line.

.1 Pipe will be measured horizontally, along top of the pipe in lineal metres from centreline of connection to centreline of connection

.2 Payment will be made for each field measured lineal metre of pipe installed.

.3 Decommissioning and removal of existing sewer mains, services lines, manholes, septic tanks, cleanouts and any other existing appertenance of any size encountered during trenching and construction operations is incidental to this Work and a separate payment for decommissioning as specified willl not be made.

.3 The unit price bid for "**200 mm Dia PVC SDR 35 Pipe c/w Insulation**" shall be considered full compensation for all materials, labour and equipment required for the installation of sanitary sewer line including: confirmation of existing tie-in inverts, supplying, loading, hauling, unloading of pre-insulated polyurethane protected pipe, trenching to the required depth, supply and placement of granular bedding material, pipe installation to the specified line and grade, backfilling to roadway subgrade elevation, trench compaction, disposal of excess material offsite, connection to manholes, flushing, cleaning, CCTV inspection, and all work incidental to the completed installation of insulated sanitary sewer main including additional costs to insulate adjacent service lines.

.1 Pipe will be measured in lineal metres from centre to centre of manholes

.2 Payment will be made for each field measured lineal metre of pipe installed.

.3 Decommissioning and removal of existing sewer mains, services lines, manholes, septic tanks, cleanouts and any other existing appertenance of any size encountered during trenching and construction operations is incidental to this Work and a separate payment for decommissioning as specified willl not be made.

.4 The unit price bid for "**100 mm Dia PVC SDR 35 Pipe (Campsite Service Line)**" shall be considered full compensation for all materials, labour and equipment required for the installation of sanitary sewer line including: confirmation of existing tie-in inverts, supplying, loading, hauling, unloading of pipe, trenching to the required depth, supply and placement of granular bedding material, pipe installation to the specified line and grade, backfilling to roadway or landscape subgrade elevation, trench compaction, disposal of excess materials off site, connection to manholes or sewer main, saddle, elbows, riser, concrete apron, self-closing hatch as detailed on the construction drawings, flushing, cleaning and all work incidental to the completed installation of sanitary sewer line.

.1 Each sanitary service line will be counted as one from the sanitary main connection to the service connection.

.2 Payment will be lump sum for each service line installed as detailed.

.3 Decommissioning and removal of existing sewer mains, services lines, manholes, septic tanks, cleanouts and any other existing appertenance of any size encountered during trenching and construction operations is incidental to this Work and a separate payment for decommissioning as specified willl not be made.

.5 The unit price bid for "**100 mm Dia PVC SDR 35 Pipe (Building Service Line)**" shall be considered full compensation for all materials, labour and equipment required for the installation of sanitary sewer line including: confirmation of existing tie-in inverts, supplying, loading, hauling, unloading of pipe, trenching to the required depth, supply and placement of granular bedding material, pipe installation to the specified line and grade, backfilling to roadway or landscape subgrade elevation, trench compaction, disposal of excess materials off site, connection to manholes or sewer main, saddle, elbows, flushing, cleaning and all work incidental to the completed installation of sanitary sewer line.

.1 Each sanitary service line will be counted as one from the sanitary main connection to the service connection.

.2 Payment will be lump sum for each service line installed.

.3 Decommissioning and removal of existing sewer mains, services lines, manholes, septic tanks, cleanouts and any other existing appertenance of any size encountered during trenching and construction operations is incidental to this Work and a separate payment for decommissioning as specified willl not be made.

.6 The unit price bid for "**Connect to Existing Sewer System**" shall be considered full compensation for all materials, labour and equipment required for tie-ins of new sanitary sewer mains to stubs or manholes including: digging, trenching, placing, supply and install couplers, concrete cutting and coring, grout, sealing, backfilling, compacting, coordination and notification required for sanitary sewer service interruption, testing, and all work incidental to the completed tie-in.

.1 Each tie-in will be counted.

.2 Payment will be made for each completed connection to an existing system.

## 1.6 SURFACE WORKS

.1 The unit price bid for "**Subgrade Preparation – 150 mm (walkways, pathways, tent sites)**" and "**Subgrade Preparation – 300 mm (roadways, parking lots, RV sites)**" shall be considered full compensation for all materials, labour and equipment required for preparing the subgrade for granular road structure application, including windrowing, scarifying, placing, blading, mixing, shaping, grading, moisture conditioning, compacting, maintaining, proof rolling, associated clean up and all work incidental to complete the work. Work shall include undercutting unstable areas and subsequent prep of minor "soft spots" to attain a stable approved subgrade surface.

.1 Each area of approved prepared subgrade will be measured by length and average width to produce an area in square metres.

.2 Payment will be made for each square metre of approved prepared subgrade surface.

.2 The unit price bid for "**Reclaimed Asphalt Pavement (RAP) Base – 100 mm thick (tent pads/path)**", "**Reclaimed Asphalt Pavement (RAP) Base – 200 mm thick (campsites)**" and "**Reclaimed Asphalt Pavement (RAP) Base – 100 mm thick (roads)**" shall be considered full compensation for all materials, labour and equipment required for RAP surfacing, including processing, loading, hauling, placing and compaction of millings on the road surface, associated clean up and all items incidental to complete the work.

.1 Recycled Asphalt Pavement Surfacing will be measured in area by length and width of approved surfaces for the depths specified. Surveyed areas are also acceptable.

.2 Payment will be made for each square metre of approved recycled asphalt pavement surfacing.

.3 The unit price bid for "**Granular Base Course – 100 mm thick (roads)**" shall be considered full compensation for all materials, labour and equipment required for the supply, placement and compaction of granular sub-base course in accordance with limit lines, compacted depths, densities, moisture content and grades specified, including: procurement, loading, processing, hauling, placing, shaping, grading, compacting, applying blotting sand when required, moisture conditioning, proof rolling, maintaining, interim lane marking, material certification, quality control, associated clean up and all items incidental to complete the work.

.1 Each area of approved granular base course will be measured in area by length and average width to produce an area in square metres.

.2 Payment will be made for each square metre of approved granular base course.

.4 The unit price bid for "**Type I Hot Mix Asphalt Concrete Pavement – 100 mm thick**" shall be considered full compensation for all materials, labour and equipment required for preparation of the job mix design and job mix formula, supply and placement of prime coat and tack coat where required, supply of aggregates and asphalt cement, mixing, transporting, placing, spreading, shaping, raking, ramping around appurtenances and compacting the asphalt to the specified thickness and density, associated clean up and all work incidental to complete the work.

.1 Each area of approved asphalt will be measured by GPS survey to produce an area in square metres.

.2 Payment will be made for each square meter of asphalt correctly placed to specifications.

.5 The unit price bid for "**Concrete Sidewalk**" shall be considered full compensation for all materials, labour and equipment required to supply and install sidewalk structures in accordance with the sections, alignments and grades specified, including: excavation, subgrade preparation, supply and install granular bedding, extruding, forming, concrete thickness as detailed, tie-bar, doweling, placement, vibrating, finishing, stripping, curing and protection of the concrete, control joints expansion joints, isolation joints, backfilling between concrete and property line to subgrade elevation, compaction, associated clean up, and all work incidental to the installation of concrete sidewalk.

.1 Each surface will be measured in area along the top surface of the sidewalk.

.2 Payment will be made for each square metre of sidewalk installed.

.6 The unit price bid for "**Concrete Pad – Kiosk**" shall be considered full compensation for all materials, labour and equipment required to construct kiosk concrete parking pad as shown on the drawings, including: saw cutting, pavement removal and disposal, excavation, subgrade preparation, supply and installation of granular bedding, forming, reinforcing, tie-bars, doweling, concrete, placement, vibrating, finishing, stripping, curing and protection of the concrete, control joints, expansion joints, isolation joints, backfilling with leancrete and granular material as required, compaction, surface restoration of adjacent surfaces, associated clean up, and all work incidental to the installation of kiosk concrete parking pad.

.1 Each kiosk parking pad will be measured per unit installed.

.2 Payment will be lump sum for each kiosk parking pad installed correctly.

.7 The unit price bid for "**Concrete Pad – Campsite**" shall be considered full compensation for all materials, labour and equipment required to supply and install concrete structures in accordance with the sections, alignments and grades specified, including: excavation, subgrade preparation, supply and install granular bedding, extruding, forming, tie-bar, doweling, 150 mm x 150 mm No. 10 gauge wire mesh, placement, vibrating, finishing, stripping, curing and protection of the concrete, control joints expansion joints, isolation joints, associated clean up, and all items incidental to complete the work.

.1 Each campsite concrete pad will be measured per unit installed.

.2 Payment will be lump sum for each concrete pad installed correctly.

.8 The unit price bid for "**Concrete Pad – Waste Receptacle**" shall be considered full compensation for all materials, labour and equipment required to supply and install concrete structures in accordance with the sections, alignments and grades specified, including: excavation, subgrade preparation, ensuring concrete pad meets PCA's requirements for minimum width and length, supply and install granular bedding,

extruding, forming, tie-bars, doweling, reinforcement as detailed, placement, vibrating, finishing, stripping, curing and protection of the concrete, control joints expansion joints, isolation joints, associated clean up, and all items incidental to complete the work. The Contractor shall also replace each recycle and waste receptacle from the stockpile area to the new concrete pad and ensure proper fit and function prior to payment.

.1 Each waste receptacle pad will be counted.

.2 Payment will be made for each waste receptacle pad installed.

.9 The unit price bid for "**Timber Tent Pad Corner Markers**" shall be considered full compensation for the supply and placement of rough cut 4"x6" pressure treated posts embedded 900 mm at the corner of each tent site as indicated on the drawings, including post hole augering, post installation, backfill and compaction, cleanup and all work required to install the posts.

.1 Posts will be measured per unit installed.

.2 Payment will be made for each post correctly installed.

.10 The unit price bid for "**Timber Roadside Bollards**" shall be considered full compensation for the supply and installation of rough cut pressure treated posts of the same diameter as removed including post hole excavation/augering, concrete, post installation, backfill and compaction, cleanup and all work required for the bollard installation.

.1 Posts will be measured per unit installed.

.2 Payment will be made for each bollard correctly installed.

.11 The unit price bid for "**Walkway Bollard (non-electrified)**" shall be considered full compensation for the supply and installation of posts as detailed including post hole excavation/augering, concrete, post installation, backfill and compaction, cleanup and all work required for the bollard installation.

.1 Posts will be measured per unit installed.

.2 Payment will be made for each bollard correctly installed.

.12 The unit price bid for "**Sign Post**" shall be considered full compensation for the supply and installation of 4x6 rough cut pressure treated traffic sign posts as indicated on the drawings including post hole excavation/augering, piles (if specified), concrete, post installation, backfill and compaction, cleanup and all work required for the post installation, excluding attachment of traffic signs.

.1 Measurement is per unit post installed.

.2 Payment will be made for each sign post correctly installed.

.13 The unit price bid for "**Traffic Signs**" shall be considered full compensation for the supply and installation of signs on posts as indicated on the drawings including all fasteners, mounting hardware and all work required to install the sign.

.1 Measurement is per each sign.

.2 Payment will be made for each sign correctly installed.

.14 The unit price bid for "**Campsite Sign Card**" shall be considered full compensation for the supply and installation of signs on posts or electrical pedestals as indicated on the drawings including all fasteners, mounting hardware and all work required to install the sign.

.1 Measurement is per each sign.

.2 Payment will be made for each sign correctly installed.

.15 The unit price bid for "**Campsite Grouping Sign Card**" shall be considered full compensation for the supply and installation of signs on posts as indicated on the

drawings including all fasteners, mounting hardware and all work required to install the sign.

.1 Measurement is per each sign.

.2 Payment will be made for each sign correctly installed.

.16 The unit price bid for "**Line Painting – Parking Stalls (100 mm wide white)**" shall be considered full compensation for all materials, labour and equipment required for completing 100 mm wide line painting, including inspecting the areas to be painted, sweeping and cleaning of surfaces, supplying of paint and glass beads, completing temporary markings, traffic accommodation, painting to the specified locations and colours, associated clean up and all items incidental to complete the work.

.1 Lines will be measured along the centreline of the completed line.

.2 Payment will be made for each lineal metre of painted line.

.17 The unit price bid for "**Line Painting – Centreline Directional Dividing (100 mm wide yellow)**" shall be considered full compensation for all materials, labour and equipment required for completing 100 mm wide line painting, including inspecting the areas to be painted, sweeping and cleaning of surfaces, supplying of paint and glass beads, completing temporary markings, traffic accommodation, painting to the specified locations and colours, associated clean up and all items incidental to complete the work.

.1 Lines will be measured along the centreline of the completed painted line.

.2 Payment will be made for each lineal metre of painted line.

.18 The unit price bid for "**Line Painting – Directional Arrows (solid white)**" shall be considered full compensation for all materials, labour and equipment required for completing directional arrows painting, including inspecting the areas to be painted, sweeping and cleaning of surfaces, supplying of paint and glass beads, completing temporary markings, traffic accommodation, painting to the specified locations and colours, associated clean up and all items incidental to complete the work.

.1 Lines will be measured as each directional arrow completed.

.2 Payment will be made for each directional arrow completed.

.19 The unit price bid for "**Line Painting – Messages (Accessible Stalls)**" shall be considered full compensation for all materials, labour and equipment required for completing painting, including inspecting the areas to be painted, sweeping and cleaning of surfaces, supplying of paint and glass beads, completing temporary markings, traffic accommodation, painting to the specified locations and colours, associated clean up and all items incidental to complete the work.

.1 Lines will be measured as each stall completed.

.2 Payment will be made for each stall completed.

.20 The unit price bid for "**Line Painting – No Parking Zones**" shall be considered full compensation for all materials, labour and equipment required for completing painting, including inspecting the areas to be painted, sweeping and cleaning of surfaces, supplying of paint and glass beads, completing temporary markings, traffic accommodation, painting to the specified locations and colours, associated clean up and all items incidental to complete the work.

.1 Lines will be measured per lineal metre of line painted.

.2 Payment will be made per lineal metre of line painted.

.21 The unit price for "**Wheel Stop Parking Curbs**" shall include the cost of surface inspection and preparation, mounting hardware as recommended by the manufacturer, supply, installation and clean up.

.1 Each wheel stop correctly installed shall be counted.

.2 Wheel stops shall be paid for each correctly installed.

.22 The unit price for "**Reflective Rubber Speed Bump**" shall include the cost of surface inspection and preparation, mounting hardware as recommended by the manufacturer, supply, installation and clean up.

.1 Each speed bump correctly installed shall be counted.

.2 Speed bumps shall be measured for payment as adequately delivered and installed individually

## 1.7 ELECTRICAL

.1 The unit price bid for "**Remove and Dispose of Existing Street Light and Base**" shall be considered full compensation for all materials, labour and equipment required for the removal of existing street lights, including: removal of associated base, filling remaining area with bedding material, backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning and all work incidental to the removal/disposal work.

.1 Each street light and base removed will be counted.

.2 Payment will be made for each successful removal/disposal of existing street lights and bases including associated cable exposed during the removal process.

.2 The unit price bid for "**Remove and Dispose of Existing Pedestal**" shall be considered full compensation for all materials, labour and equipment required for the decommissioning of an existing RV pedestal and CDP panel, including: removal of associated base, filling remaining area with bedding material, backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning and all work incidental to the removal/disposal of existing pedestals and bases.

.1 Each pedestal removed will be counted.

.2 Payment will be made for each successful removal/disposal of existing pedestals and bases including associated cable exposed during the removal process.

.3 The unit price bid for "**Remove and Dispose of Existing Electrical Transformer Base**" shall be considered full compensation for all materials, labour and equipment required for the removal of existing transformer bases, including: removal of associated base, filling remaining area with bedding material, backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning and all work incidental to the removal/disposal work.

.1 Measurement will be made in a lump sum quantity.

.2 Payment will be made for each successful removal/disposal of existing base.

.4 The unit price bid for "**Relocate Existing RV Pedestal and Terminations**" shall be considered full compensation for all materials, labour and equipment required for the relocation of an existing RV pedestal, including: removal of associated base, filling remaining area with bedding material, backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning and all work incidental to the removal and relocation of existing pedestal.

.1 Measurement will be made in a lump sum quantity.

.2 Payment will be made for each successful relocation of existing pedestal and bases including associated cable.

.5 The unit price bid for "**Disconnect Existing Cable Feed in Bathroom and Kitchen Facilities**" (Remove existing cable feed and pull new feeder into electrical panel and terminate) will be considered full payment for all labour, equipment and materials required to adequately remove existing cable feed into the building replacing it with new.

.1 Measurement will be made in a lump sum quantity.

.2 Payment will be made as a lump sum for each successful cable installation into the existing electrical panel including termination into the existing breaker.

.6 The unit price bid for "**Supply and Install 240V 50A – 120V 30A/15A RV Pedestal and Base**" shall be considered full compensation for all materials, labour and equipment required for the installation of each Pedestal and associated base.

.1 Each Pedestal will be counted.

.2 Payment will be made for each pedestal installed.

.7 The unit price bid for "**Supply and Install 240V 50A – 120V 30A/15A RV Pedestal and Base (Loop G)**" shall be considered full compensation for all materials provided to Parks Canada Agency.

.1 Each Pedestal will be counted.

.2 Payment will be made for each pedestal provided to Parks Canada Agency.

.8 The unit price bid for "**Supply and Install 240V 50A – 120V 30A/15A RV Pedestal and Base (Spare)**" shall be considered full compensation for all materials provided to Parks Canada Agency.

.1 Each Pedestal will be counted.

.2 Payment will be made for each pedestal provided to Parks Canada Agency.

.9 The unit price bid for "**Supply and Install 3c # 4/0 ACWU90 Cable – RV Pedestals**" shall be considered full compensation for all materials, labour and equipment required for the installation of cables and required terminations; fittings, connections.

.1 Cable will be measured linearly from actual installation.

.2 Payment will be made for each field measured linear metre of cable installed.

.10 The unit price bid for "**Supply and Install 3c # 1/0 AL ACWU90 Cable – RV Pedestals**" shall be considered full compensation for all materials, labour and equipment required for the installation of cables and required terminations; fittings, connections.

.1 Cable will be measured linearly from actual installation.

.2 Payment will be made for each field measured linear metre of cable installed.

.11 The unit price bid for "**Supply and Install 2c # 4 AL USEB Cable – Street Lighting & Bollard Lighting**" shall be considered full compensation for all materials, labour and equipment required for the installation of cables and required terminations; fittings, connections.

.1 Cable will be measured linearly from actual installation.

.2 Payment will be made for each field measured linear metre of cable installed.

.12 The unit price bid for "**Supply and Install 3X [102mmC, 3# 500MCM Cu. Cable] + Grd**" shall be considered full compensation for all materials, labour and equipment required for the installation of cables, conduit and required terminations; fittings, connections.

.1 Cable will be measured linearly from actual installation.

.2 Payment will be made for each field measured linear metre of cable installed.

.3

.13 The unit price bid for "**Supply and Install 3X [102mmC, 3# 300MCM Cu. Cable] + Grd**" shall be considered full compensation for all materials, labour and equipment required for the installation of cables, conduit and required terminations; fittings, connections.

.1 Cable will be measured linearly from actual installation.

.2 Payment will be made for each field measured linear metre of cable installed.

.14 The unit price bid for "**Supply and Install 2X [102mmC, 3# 300MCM Cu. Cable] + Grd**" shall be considered full compensation for all materials, labour and equipment required for the installation of cables, conduit and required terminations; fittings, connections.

.1 Cable will be measured linearly from actual installation.

.2 Payment will be made for each field measured linear metre of cable installed.

.15 The unit price bid for "**Supply and Install 102mm DB2 Conduit for Primary (as per FortisAlberta guidelines)**" shall be considered full compensation for all materials, labour, FortisAlberta coordination, and equipment required for the successful installation of conduits within the trench deemed acceptable by the FortisAlberta Field Coordinator.

.1 Conduit will be measured per linear metre.

.2 Payment will be made for each field measured linear metre of conduit.

.16 The unit price bid for "**Trenching for Primary – As per FortisAlberta guidelines (Inc. bedding/compaction/backfill)**", shall be considered full compensation for all materials, labour, FortisAlberta coordination, and equipment required for the successful installation of conduits and appropriate compaction, backfill and send bedding within the trench deemed acceptable by the FortisAlberta Field Coordinator.

.1 Trenching will be measured per linear metre.

.2 Payment will be made for each field measured linear metre of trench.

.17 The unit price bid for "**Trenching for Secondary (Inc. bedding/compaction/ backfill for RV Pedestal, street light and building feed trench)**" shall be considered full compensation for all materials, labour and equipment required for the installation of cables, conduits and appropriate compaction, backfill and send bedding within the trench.

.1 Trenching will be measured per linear metre.

.2 Payment will be made for each field measured linear metre of trench.

.18 The unit price bid for "**Supply and Install Weather Rated Service Entrance Distribution Panel (Inc. main breaker, feeder breakers, concrete base, etc**." shall be considered full compensation for all materials, labour and equipment required for the installation of each Distribution Panel and associated base.

.1 Each Panel will be counted.

.2 Payment will be made for each Panel installed including connections, terminations within the panel and transformer.

.19 The unit price bid for "**Supply and Install Transformer Base c/w Grounding (as per FortisAlberta guidelines)**", shall be considered full compensation for all materials, labour, FortisAlberta coordination, and equipment required for the installation of each transformer base and associated grounding and deemed acceptable by the FortisAlberta Field Coordinator.

.1 Each transformer base will be counted.

.2 Payment will be made for each transformer base installed.

.20 The unit price bid for "**Install Cable Feed into Buildings**" (Remove existing cable feed and pull new feeder into electrical panel and terminate) will be considered full payment

for all labour, equipment and materials required to adequately remove existing cable feed into the building replacing it with new.

.1 Measurement will be made in a lump sum quantity.

.2 Payment will be made as a lump sum for each successful cable installation into the existing electrical panel including termination into the existing breaker.

.21 The unit price bid for "**Supply and Install Decorative LED Dark Sky Friendly Street Light, Pole and Base**" shall be considered full compensation for all materials, labour and equipment required for the installation of the street lights and associated bases.

.1 Each street light will be counted.

.2 Payment will be made for each street light installed.

.22 The unit price bid for "**Supply and Install LED Dark Sky Friendly Bollard Light**" shall be considered full compensation for all materials, labour and equipment required for the installation of the bollard lights and associated bases.

.1 Each street light will be counted.

.2 Payment will be made for each street light installed.

.23 The unit price bid for "**Arc flash and Coordination Study**" shall be considered full compensation for the approved stamped study and associated resulted stickers.

.1 Measurement will be made for each completed approved study report.

.2 Payment will be made on each received approved study report.

.24 The unit price bid for "**FortisAlberta Cash Allowance**" shall be considered full compensation for the approved FortisAlberta invoicing related to the Service Agreements and design.

.1 Measurement will be made for each service agreement and design cost received.

.2 Payment will only be made with appropriate cost estimate received from FortisAlberta.

## 1.8 STRUCTURAL

.1 The unit price bid for "**Bridge Repairs - Rail Post Concrete Repairs**, **Debris Removal from Abutments, Sidewalk Approach Ramp Repairs**" shall be considered full compensation for all materials, labour and equipment required to complete the work described on the construction drawings, including: removing, loading, hauling, handling, safeguarding, transporting, grouting, installing, shaping, associated clean up and all items incidental to complete the work.

.1 Measurement will be made as a lump sum quantity for all Work.

.2 Payment will be in a lump sum for all Work.

.2 The unit price bid for "**Relocate Existing Kitchen #4 (non-heritage building)**" and "**Relocate Existing Kitchen #13 (Federal Heritage building)**" shall be considered full compensation for all materials, labour and equipment required to move each building from its current location in Loop A to the new location in Loop B. Costs shall include, but is not limited to, accommodating existing and new utilities, structural stabilization, jacking, moving buildings by professional moving company approved by Departmental Representative, construction of new concrete pads as detailed, placing and securing on new concrete foundations, obtaining permits, and any other requirements to move the buildings to the new location.

.1 Measurement will be for each building moved.

.2 Payment will be lump sum for each building moved.

## 1.9 LANDSCAPE

.1 The unit price bid for "**Remove and Dispose Existing Tree**" shall be considered full compensation for all materials, labour and equipment required for the removal and off-site disposal of trees, roots, stumps and branches, including: cutting of all wood 75 mm diameter and greater into 400 mm lengths to be hauled to an area designated by the Departmental Representative, excavating roots to a 1 metre depth, excavating, loading, hauling, backfilling, compacting, associated clean up and all items incidental to complete the work.

.1 All trees marked for removal require a Restricted Activity Permit from the Park Warden Office.

.2 Tree removal will be measured per each unit for all designated and approved trees.

.3 Payment will be made per each tree removed.

.2 The unit price bid for "**Supply and Install Deciduous and Coniferous Tree**" shall be considered full compensation for all materials, labour and equipment required for the supply and install of trees, including: procurement, loading, hauling, handling, safeguarding, transporting, excavation, planting, backfilling, compacting, erosion and sediment control matting (below grade), mulch, watering, staking, tree protection from wildlife and construction, associated clean up and all items incidental to complete the work as shown on the planting plans and tree detail.

.1 Each planted tree approved by Departmental Representative will be counted.

.2 Payment will be made for each tree correctly planted.

.3 The unit price bid for "**Supply and Install Shrub**" shall be considered full compensation for all materials, labour and equipment required for the supply and planting of shrubs, including: procurement, loading, hauling, handling, safeguarding, transporting, excavation, planting, backfilling, compacting, watering, staking, protection from wildlife and construction, associated clean up and all items incidental to complete the work.

.1 Each planted shrub approved by Departmental Representative will be counted.

.2 Payment will be made for each shrub correctly planted.

.4 The unit price bid for "**Stockpiled Topsoil Placement and Grading**" shall be considered full compensation for all materials, labour and equipment required for the re-placement of stripped topsoil to the depths indicated including: loading, hauling, placing, spreading, trimming, blading, shaping finishing, finish grading, and associated clean up and all items incidental to complete the work.

.1 Each topsoiled area will be measured by survey to produce an area in square metres and to the depths specified in accordance with the drawings.

.2 Payment will be made for each square metre of area topsoil placed and graded prior to seeding.

.5 The unit price bid for "**Imported Topsoil**" shall be considered full compensation for the supply and import of topsoil from a supplier approved by the Departmental Representative, mixing of imported topsoil with native topsoil stockpiled in the Red Rock SMS area at a ratio of 1:2, all labour, materials, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Departmental Representative.

.1 Measurement of Imported Topsoil will be in cubic meters placed as determined by survey of area and average depth.

.2 Payment for Imported Topsoil will be made at the unit price bid per cubic metre.

.6 The unit price bid for "**Sod**" shall be considered full compensation for the supply and placement of turf grass sod, and includes all labour, materials, equipment, tools and

incidentals necessary to complete the Work to the satisfaction of the Departmental Representative. The repair of eroded areas prior to sodding will be considered incidental to the Work and no separate payment will be made.

.1 Sod will be measured in square meters based on areas shown on construction drawings, and as approved by the Departmental Representative. No allowance will be made for uneven or sloping ground, or overlap.

.2 Payment for Sodding will be made at the unit price bid per square metre.

.7 The unit price bid for "**Hydro-Seeding**" shall be considered full compensation for the supply and placement of seed, hydro-mulch and reseeding as applicable, and includes all labour, materials, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Departmental Representative. The repair of eroded areas prior to seeding will be considered incidental to the Work and no separate payment will be made.

.1 Seeding will be measured in square meters to the based on horizontal measurements as determined by the Departmental Representative. No allowance will be made for uneven or sloping ground, or overlap.

.2 Payment for Hydro-Seeding will be made at the unit price bid per square metre.

.8 The unit price bid for "**Post and Rail Fence**" shall be considered full compensation for the supply and placement of fence as indicated on the drawings, including pressure treated timber posts, timber rails, hardware, post hole augering, post installation, levelling, backfill and compaction, clean-up and all work required to install the fence.

.1 Fence will be measured per linear metre installed.

.2 Payment will be made for each linear metre correctly installed.

.9 The unit price bid for "**Barrier Rail**" shall be considered full compensation for the supply and installation of barrier rails as indicated on the drawings including posts, barrier rails, hardware, campsite ID card posts where indicated, post hole excavation/augering, levelling, concrete, post installation, backfill and compaction, clean-up, and all work required for the installation.

.1 Measurement is per unit barrier rail installed.

.2 Payment will be made for each barrier rail correctly installed.

.10 The unit price bid for "**Swing Gate – Single Arm**" shall be considered full compensation for the supply and placement of gate as indicated on the drawings, including steel posts, steel arm, hardware, powder coating, reflective tape, post hole augering, post installation, levelling, concrete, backfill and compaction, cleanup and all work required to install the fence.

.1 Each gate will be counted.

.2 Payment will be made for each gate correctly installed.

.11 The unit price bid for "**Swing Gate – Double Arm**" shall be considered full compensation for the supply and placement of gate as indicated on the drawings, including steel posts, steel arms, hardware, powder coating, reflective tape, post hole augering, post installation, levelling, concrete, backfill and compaction, cleanup and all work required to install the fence.

.1 Each gate will be counted.

.2 Payment will be made for each gate correctly installed.

## 1.10 MISCELLANEOUS

.1 The unit price bid for "**Boulder Removal**" shall be considered full compensation for the removal of boulders in excess of 1.0 $m^3$ and include all labour, equipment, tools and

incidentals necessary to complete the Work. All boulders shall remain onsite and placed within the campground as directed by the Departmental Representative.

.1 Boulder Removal will be measured in cubic meters based on volume measurements as determined by the Departmental Representative.

.2 Payment for Boulder Removal will be made at the unit price bid per cubic meter.

.2 The unit price bid for "**Unstable Subgrade Removal**" shall be considered full compensation for the removal of unstable subgrade and include all labour, materials, equipment, disposal of the unstable material, tools and incidentals necessary to complete the Work to the satisfaction of the Departmental Representative.

.1 Unstable Subgrade Removal will be measured in cubic meters based on horizontal and vertical measurements and calculated through average end area calculations, as determined by the Departmental Representative.

.2 Payment for Unstable Subgrade Removal will be made at the unit price bid per cubic meter.

.3 The unit price bid for "**Imported Stabilization Gravel**" shall be full payment for the supply and placement of imported stabilization gravel and include all labour, equipment, hauling, placing and compacting the material

.1 Imported Stabilization Gravel will be measured in cubic meters based on horizontal and vertical measurements as determined by the Departmental Representative.

.2 Payment for Imported Stabilization Gravel will be made at the unit price bid per cubic meter.

.4 The unit bid price for "**Nonwoven Geotextile Filter Fabric**" shall be full payment for the for the supply and install of nonwoven geotextile filter fabric and include all labour, equipment, hauling and tools and incidentals necessary to complete the Work satisfactory to the Departmental Representative.

.1 Nonwoven Geotextile Filter Fabric will be measured in square meters to the based on horizontal measurements as determined by the Departmental Representative. No allowance will be made for uneven or sloping ground, or overlap.

.2 Payment for nonwoven Geotextile Filter Fabric will be made at the unit price bid per square metre.

.5 The unit price bid for "**PVC Conduits**" shall be considered full compensation for the supply and placement of conduits, backfill, installation of warning tape, and includes all labour, materials, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Departmental Representative. Conduits shall be Polytubes, Carlon or approved equivalent.

.1 Measurement will be taken along the centreline of installed conduit.

.2 Payment will be made for each lineal metre installed conduit.

## 1.11 PAYMENT

.1 The lump sum prices in the Schedule(s) of the Bid Form shall be full compensation to the Contractor for everything done or furnished by him to complete the pay item as required by the Contract Documents and the Departmental Representative. Such items as applicable taxes on materials, transportation costs, access roads, permit and patent fees, overhead and profit and all miscellaneous expenses are to be included in the various prices.

.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 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Departmental Representative may reasonably require to establish value and delivery of products.

## PART 2. PRODUCTS

### 2.1 NOT USED

.1 Not Used.

## PART 3. EXECUTION

### 3.1 NOT USED

.1 Not Used.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ADMINISTRATIVE

.1 The Departmental Representative will administer the Pre-Construction Meeting, Daily Issue Meetings, Progress Meetings and the Site Administration / Contract Coordination Meetings.

.2 The Departmental Representative will give advance notice of meeting dates, times and locations to participants.

.3 The Departmental Representative will chair the meetings and record minutes, action items and decisions, and circulate the minutes to PCA and Contractor. The Contractor is to circulate the minutes to Sub-Contractors, Suppliers and Manufacturers.

.4 The Contractor shall ensure that all meetings are attended by at least the Contractor's Superintendent, the Contractor's Project Manager and senior representatives of major Sub-Contractors, if requested by the Departmental Representative.

.5 Ensure representatives of the Contractor, Sub-Contractor and Suppliers or Manufacturers attending the meetings are qualified and authorized to act on behalf of the party each represents.

.6 Notify the Departmental Representative in writing of any discrepancies or inconsistencies within two (2) days of receipt of minutes for recording in the next meeting. Failure to notify the Departmental Representative of discrepancies or inconsistencies within two (2) days of receipt of minutes will be deemed acceptance of the minutes as recorded.

### 1.2 PRE-CONSTRUCTION MEETING

.1 Approximately seven (7) days after receipt of the Notice of Award, the Departmental Representative will schedule a meeting to discuss administrative procedures and responsibilities.

.2 The Contractor's Superintendent, the Contractor's Project Manager and senior representatives of major Sub-Contractors involved in the Work, shall be in attendance.

.3 The meeting will be held onsite or at an alternate location in Waterton.

.4 Agenda includes the following:

.1 Appointment of official representative of participants in the Work (Contractor's Superintendent, Contractor's Project Manager, Contractor's Safety Professional, Contractor's Scheduler and Quantity Surveyor, Contractor's Foreman, the Resident Engineer and a Departmental Representative).

.2 Responsibilities of the Contractor, and the Departmental Representative.

.3 Site safety, site restrictions and hours of operation.

.4 Occupational health and safety relationships and responsibilities. Submittal of Site Safety Manual and implementation of Site orientation program.

.5 Sustainable issues compliance and coordination.

.6 Schedule of Work, progress scheduling.

.7 Schedule of submittals.

.8 Requirements and schedule for temporary facilities, offices, utilities, fences.

.9 Delivery schedule of major and key equipment.

.10 Site security and arrangements for Departmental Representative and PCA access to the Site.

.11 Document Management Procedures (method of tracking and filing requests for information (RFIs), COs, etc., procedures used for logging record drawing information, and other document related issues).

.12 Submittal procedures and schedule.

.13 Change Order procedures.

.14 Record Drawings.

.15 Operation manuals and maintenance data.

.16 Commissioning, acceptance, warranties.

.17 Monthly progress payments, administrative procedures, holdbacks, protocols for communication, reporting, inspection etc.

.18 Inspection and testing agencies or firms.

.19 Ambiguities or questions of interpretation identified in the Contract Documents.

## 1.3 DAILY ISSUE MEETINGS

.1 The Contractor's Superintendent and the Contractor's Project Manager shall be in attendance.

.2 The meeting shall be held in the Contractor's site trailer.

.3 Agenda to include any issues / concerns.

## 1.4 PROGRESS MEETINGS

.1 The Contractor's Superintendent, Contractor's Project Manager and senior representatives of major Sub-Contractors involved in the Work shall be in attendance.

.2 The Progress Meetings will be held at the Waterton Lakes Operations Building on a weekly basis.

.3 Sample agenda includes the following items:

.1 Review approval of minutes of previous meeting.

.2 Old business.

.3 Occupational health and safety incidents, records and procedures.

.4 Schedule (provide a 3-week 'look-ahead' schedule – Refer to Section 01 32 16 Construction Progress Schedule).

.5 Document Management Issues.

.6 Submittal status.

.7 Requests for information.

.8 Proposed Contract modifications.

.9 Change Order status.

.10 Site coordination.

.11 Quality control.

.12 Site cleanliness.

.13 Erosion and Sedimentation Control Measures.

.14 Construction Site Solid Waste Management Program.

.15 Other action items.

.4 Submit for information only, in accordance with Section 01 33 00 Submittal Procedures, at each regularly scheduled progress meeting:

.1 Totals of all personnel currently on Site associated with the Contract, broken down by trade and Sub-Contractor including all staff.

.2 Totals of all major equipment currently on Site, over a two thousand dollar replacement value, broken down by type and Sub-Contractor.

**1.5 SITE ADMINISTRATION / CONTRACT COORDINATION MEETINGS**

.1 At monthly intervals, or more frequently as required, the Departmental Representative will call a Site Administration / Contract Coordination Meeting. The purpose of this meeting will be to discuss and resolve issues relating to the interactions among the various ongoing works.

.2 The Contractor's Superintendent and Contractor's Project Manager shall be in attendance.

.3 Agenda will include issues related to site administration or construction contract coordination.

**1.6 SPECIAL MEETINGS**

.1 Special meetings may be held at the request of the Departmental Representative, PCA, or the Contractor to discuss specific items. Arrange for attendance by parties requested by the Departmental Representative.

.2 The Contractor shall either conduct separate construction Waste Management Meetings or discuss waste management goals and issues as part of the Pre-Construction Meeting and Progress Meetings.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED REQUIREMENTS

.1 Sections as noted herein.

### 1.2 DEFINITIONS

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

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. 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, i.e. MS Project.

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

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

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

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

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

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones.

.9 Dynamic: a detailed record of tasks or activities that must be accomplished to satisfy Project objectives.

.10 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.

### 1.3 REQUIREMENTS

.1 Ensure Master Plan and detail schedules are practical and remain within specified Contract duration.

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

.3 Limit activity durations to maximum of approximately 14 working days, to allow for progress reporting.

.4 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.

.5 The Bar Chart shall identify the activities on the Critical Path.

.6 The Schedule shall be created and submitted through the use of Microsoft Project.

### 1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to Consultant within fourteen (14) days of Award of Contract, a Bar (GANTT) Chart as the Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Consultant within seven days of receipt of acceptance of Master Plan.

.4 Schedule submissions shall include an electronic copy in PDF format and an electronic copy in the Microsoft Project format.

## 1.5 MASTER PLAN

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

.2 Departmental Representative will review and return revised schedules within seven days.

.3 Revise unworkable schedule and resubmit within seven days.

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

## 1.6 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

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

.1 Award

.2 Shop Drawings, Samples, Permits

.3 Mobilizations/Demobilizations

.4 Decommissioning and Removals

.5 Building Construction

.6 Earthworks

.7 Water and Sewer Mains

.8 Water and Sewer Services

.9 Irrigation Services

.10 Primary Electrical and Transformers

.11 Secondary Electrical Distribution

.12 Chlorinating, Testing and Commissioning

.13 Concrete Works

.14 Roadway Preparation

.15 Roadway Paving

.16 Walkways/Pathways/Tent Pads

.17 Topsoil, Sodding and Seeding

.18 Tree Planting including advance “test” planting

.19 Access disruptions

.20 Other activities and milestones necessary to complete the project

.21 Anything else that may impact any Parks Canada Agency operations

## 1.7 PROJECT SCHEDULE REPORTING

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

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

**1.8 PROJECT MEETINGS**

.1 Discuss Project Schedule at regular Project Meetings, identify activities that are behind schedule and provide remediation measures to regain schedule slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with remedial measures will be discussed and negotiated.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ADMINISTRATIVE

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

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

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

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

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

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

.7 Verify field measurements and affected adjacent Work has been coordinated.

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

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

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

### 1.2 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit drawings stamped and signed by Professional Engineer registered or licensed in Alberta, Canada.

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

.4 Allow 7 days for Departmental Representative’s review of each submission.

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

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

.7 Accompany submissions with transmittal letter, in duplicate, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.8 Submissions include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

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

.10 Submit PDF copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit PDF of product data sheets or brochures for requirements requested in specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit PDF copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by the Departmental Representative

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

.14 If upon review by the 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.

.15 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.

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

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

**1.3 SAMPLES**

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

.2 Deliver samples prepaid to Departmental Representative's site office.

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

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

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

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

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

**1.4 PHOTOGRAPHIC DOCUMENTATION**

.1 Submit electronic copy of colour digital photography in JPG standard resolution or PDF.

.2 Take daily photographs of all underground and surface improvement work.

.3 Take photographs of site conditions before, during, and after construction. Take photographs of any unique or unusual items.

.4 Photographs to be submitted to Departmental Representative on CD, DVD or USB drive at completion of project or upon request.

**1.5 CERTIFICATES AND TRANSCRIPTS**

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

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SUMMARY

.1 Section includes content requirements, submittal procedures and administration of Operation and Maintenance Manuals.

### 1.2 DEFINITIONS

.1 Operation and Maintenance (O&M) Manuals:

.1 Contain the techncial information required for proper installation and maintenance of building materials and finishes.

.2 Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

### 1.3 SUBMITTAL SCHEDULE

.1 Operation and Maintenance Manuals and completed Equipment Record Sheets: Initial submittal within 30 working days after date Shop Drawings are approved by Departmental Representative.

### 1.4 PREPARATION OF SUBMITTALS

.1 General:

.1 All submittals and all pages of all copies of a submittal shall be completely legible.

.2 Drawings shall be computer generated. Hand drawn sketches are not acceptable.

.3 Submittals which, in the Departmental Representative's sole opinion, are illegible will be returned without review.

.4 Materials are provided for Parks Canada Agency use, reproduction and distribution as training and reference materials within Parks Canada Agency organization.

.1 Applicable to hard copy or electronic media.

.2 Applicable to materials containing copyright notice as well as those with no copyright notice.

.5 Notify manufacturer of the intended use of materials provided under this Contract.

.6 Number each Operation and Maintenance Manual transmittal with the original root number of the associated Shop Drawing.

.1 Identify resubmittals with the original number plus a suffix letter starting with "A."

.2 Submittal format:

.1 Review submittals: Submit two (2) paper copies of the complete O&M document to Departmental Representative for review and approval.

.2 Final submittals:

.1 Within 20 days of receipt of approval, submit one (1) additional paper copy and two (2) electronic copies on Compact Disc (CD-ROM) in Portable Document Format (PDF).

.1 Compact discs to be secured in jewel cases.

.2 Electronic copies will be reviewed for conformance with the approved paper copy and the electronic copy (PDF) requirements of this Specification.

.3 Non-conforming CDs will be returned with comments.

.1 Provide final CDs within 20 days of receipt of comments.

.3 Paper copy submittals:

.1 Submit Operation and Maintenance Manuals printed on 8-1/2 x 11 IN size heavy first quality paper with standard three-hole punching and bound in appropriately sized three-ring (or post) vinyl view binders with clear overlays front, spine and back.

.1 Provide binders with titles inserted under clear overlay on front and on spine of each binder.

.1 As space allows, binder titles shall include, but not necessarily be limited to, Project Name and number, related Specification Number and Equipment Name(s) & Tag Numbers.

.2 Provide a Cover Page for each manual with the following information:

.1 Manufacturer(s).
.2 Date.
.3 Project Owner and Project Name.
.4 Specification Section.
.5 Project Equipment Tag Numbers.
.6 Model Numbers.
.7 Engineer.
.8 Contractor.

.3 Provide a Table of Contents or Index for each manual.

.4 Use plastic-coated dividers to tab each section of each manual per the manual's Table of Contents/Index for easy reference.

.5 Provide plastic sheet lifters prior to first page and following last page.

.2 Reduce Drawings or diagrams bound in manuals to an 8-1/2 x 11 IN or 11 x 17 IN size.

.1 Where reduction is not practical to ensure readability, fold larger Drawings separately and place in vinyl envelopes which are bound into the binder.

.2 Identify vinyl envelopes with Drawing numbers.

.3 Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project.

.1 Delete or cross out information that does not specifically apply to the Project.

.4 Electronic copy submittals:

.1 Electronic copies of the approved paper copy Operation and Maintenance Manuals are to be produced in Adobe Acrobat's Portable Document Format (PDF) Version 5.0 or higher.

.2 Do not password protect and/or lock the PDF document.

.3 Create one (1) PDF format document for each equipment O&M Manual.

.4 Drawings or other graphics must be converted to PDF format and made part of the PDF document.

.5 Scanning to be used only where actual file conversion is not possible.

.6 Rotate pages that must be viewed in landscape to the appropriate position for easy reading.

.7 Images shall only be scanned at a resolution of 300 dpi or greater.

.8 Perform Optical Character Recognition (OCR) capture on all images.

.9 Achieve OCR with the "original image with hidden text" option.

.10 Word searches of the PDF document must operate successfully to demonstrate OCR compliance.

.11 Create bookmarks in the navigation frame, for each entry in the Table of Contents/Index.

.1 Normally three levels deep (i.e., "Chapter," "Section," "Sub-section").

.12 Thumbnails must be generated for each PDF file.

.13 Set the opening view for PDF files as follows:

.1 Initial view: Bookmarks and Page

.2 Magnification: Fit in Window.

.3 Page layout: Single page.

.4 Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.

.5 All PDF documents shall be set with the option "Fast Web View" to open the first pages of the document for the viewer while the rest of the document continues to load.

.14 File naming conventions:

.1 File names shall use the following convention (XXXXXX-YY-Z.PDF) where XXXXXX is the Specification Section number, YY is the Shop Drawing Root number and Z is an ID number used to designate the associated volume.

.15 Labeling:

.1 As a minimum, include the following labeling on all CD-ROM discs and jewel cases:

.1 Project Name.

.2 Equipment Name and Project Tag Number.

.3 Project Specification Section.

.4 Manufacturer Name.

.5 Vendor Name.

.16 Binding:

.1 Include labeled CD(s) in labeled jewel case(s).

.1 Bind jewel cases in standard three-ring binder Jewel Case Page(s), inserted at the front of the Final paper copy submittal.

.2 Jewel Case Page(s) to have means for securing Jewel Case(s) to prevent loss (e.g., flap and strap).

.5 Operation and Maintenance Manuals for Materials and Finishes:

.1 Building Products, Applied Materials and Finishes:

.1 Include product data, with catalog number, size, composition and color and texture designations.

.2 Provide information for re-ordering custom manufactured products

.2 Instructions for Care and Maintenance:

.1 Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.

.3 Moisture Protection and Weather Exposed Products:

.1 Include product data listing, applicable reference standards, chemical composition, and details of installation.

.4 Provide recommendations for inspections, maintenance and repair.

.5 Additional requirements as specified in individual product specifications.

.6 Operation and Maintenance Manuals for Equipment and Systems:

.1 Submission of Operation and Maintenance Manuals for equipment and systems is applicable but not necessarily limited to:

.1 Major equipment.

.2 Equipment powered by electrical, pneumatic or hydraulic systems.

.3 Specialized equipment and systems including instrumentation and control systems and system components for HVAC process system control.

.4 Valves and water control gates.

.2 Equipment and Systems Operation and Maintenance Manuals shall include, but not necessarily be limited to, the following completed forms and detailed information, as applicable:

.1 Fully completed type-written copies of the associated Equipment Record(s), Exhibits B1, B2 and B3, shall be included under the first tab following the Table of Contents of each Operation and Maintenance Manual.

.1 Each section of the Equipment Record must be completed in detail.

.2 Simply referencing the related manual for nameplate, maintenance, spare parts or lubricant information is not acceptable.

.3 For equipment items involving components or subunits, a fully completed Equipment Record Form is required for each operating component or subunit.

.4 Submittals that do not include the associated Equipment Record(s) will be rejected without further content review.

.5 Electronic copies of the Exhibits may be obtained by contacting the Project Manager.

.3 Equipment function, normal operating characteristics, limiting operations.

.4 Assembly, disassembly, installation, alignment, adjustment, and checking instructions.

.5 Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.

.6 Lubrication and maintenance instructions.

.7 Troubleshooting guide.

.8 Parts lists:

.1 Comprehensive parts and parts price lists.

.2 A list of recommended spare parts.

.3 List of spare parts provided as specified in the associated Specification Section.

.4 Outline, cross-section, and assembly Drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.

.5 Test data and performance curves.

.6 As-constructed fabrication or layout Drawings and wiring diagrams.

.7 Instrumentation or tag numbers assigned to the equipment by the Contract Documents are to be used to identify equipment and system components.

.8 Additional information as specified in the associated equipment or system Specification Section.

## 1.5 TRANSMITTAL OF SUBMITTALS

.1 Operation and Maintenance Manuals:

.1 Submit to Departmental Representative with reasonable promptness and in an orderly sequence as to not cause delay of work:

.1 All submittals must be from Contractor following review for completeness.

.2 Submittals will not be received from or returned to subcontractors.

.3 Operation and Maintenance Manual submittal stamp may be Contractor's standard approval stamp.

.4 Provide submittal information defining specific equipment or materials utilized on the Project.

.1 Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.

.2 Expedited Return Delivery:

.1 Include prepaid express envelope or airbill in submittal transmittal package for any submittals Contractor expects or requires express return mail.

.2 Inclusion of prepaid express envelope or airbill does not obligate Departmental Representative to conduct expedited review of submittal.

.3 Email Transmittals are permitted.

.1 Requires hard copy transmittal to immediately follow.

.1 Departmental Representative will proceed with review of email transmittal.

.2 Departmental Representative's approval or rejection comments will be recorded.

.2 Provisions apply to both:

.1 Initial transmittal contents.

.2 Supplemental information required to make initial transmittal contents complete.

**1.6 DEPARTMENTAL REPRESENTATIVE'S REVIEW ACTION**

.1 Operation and Maintenance Manuals:

.1 Departmental Representative will review and indicate one of the following review actions:

.1 A - ACCEPTABLE.

.2 B - REVISE AND RESUBMIT.

.2 Acceptable paper copy submittals will be retained with the transmittal form returned with a request for one (1) additional paper copy and two (2) electronic copies on CD-ROM.

.3 Deficient submittals (paper copy and/or electronic copy) will be returned along with the transmittal form which will be marked to indicate deficient areas.

**PART 2. PRODUCTS**

**2.1 NOT USED.**

**PART 3. EXECUTION**

**3.1 NOT USED.**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 MEASUREMENT PROCEDURES

.1 Cost of traffic control will not be paid for directly, but shall be considered incidental to contract unit prices tendered.

### 1.2 REFERENCES

.1 Alberta Infrastructure and Transportation:

.1 Traffic Accommodation in Work Zones.

### 1.3 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.

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

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

.4 When working on travelled way:

.1 Place equipment in position to minimize interference and hazard to travelling public.

.2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.

.3 Do not leave equipment on travelled way overnight.

.5 Close lanes of road only after receipt of written approval from Departmental Representative

.1 Before re-routing traffic erect suitable signs and devices in accordance to Manual of Uniform Traffic Control Devices for Streets and Highways

.2 Keep travelled way graded, free from pot holes and of sufficient width for required number of traffic lanes.

.1 Provide minimum 7 metre wide temporary roadway for traffic in two-way sections through Work zones and detours.

.2 Provide minimum 5 metre wide temporary roadway for traffic in one-way sections through Work zones and detours.

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

### 1.4 INFORMATIONAL AND WARNING DEVICES

.1 Contractor shall submit a Traffic Accommodation Strategy (TAS) prior to commencement of Work.

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

.3 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in Manual of Uniform Traffic Control Devices for Streets and Highways.

.4 Place signs and other devices in locations recommended in Manual of Uniform Traffic Control Devices for Streets and Highways.

.5 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.

.6 Continually maintain traffic control devices in use:

.1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Remove or cover signs which do not apply to conditions existing from day to day.

**1.5 CONTROL OF PUBLIC TRAFFIC**

.1 Provide competent flag personnel, trained in accordance with, and properly equipped as specified in Manual of Uniform Traffic Control Devices for Streets and Highways for situations as follows:

.1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.

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

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

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

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

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

.2 Protect travelling public from damage to person and property.

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

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

.5 Dust control to be chemical free.

.6 Provide snow removal during period of Work.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 REFERENCES

.1 Contractor shall comply with the latest versions of:

.1 Canada Labour Code, Occupational Health and Safety Act, Regulations and Code.

.2 Alberta Occupational Health and Safety Act, Regulation and Code.

.3 Health Canada Hazardous Products Act and associated Regulations.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit site-specific Health and Safety Plan within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Submit Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly, including minutes of safety toolbox meetings.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS Material Safety Data Sheets to Departmental Representative. Contractor shall use Globally Harmonized System (GHS) for Classifying and Labelling Chemicals in accordance with changes to WHMIS Legislation.

.7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 workdays after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 days after receipt of comments from Departmental Representative.

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

.9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

.10 Onsite Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

.11 Emergencies: In the event of emergency call 911 or (403) 859-2636. Once the primary call is made immediately call the Departmental Representative to inform him the nature of the emergency

.1 All other inquiries: Parks Canada Agency Switchboard (403) 859-2224.

### 1.3 FILING OF NOTICE

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

## 1.4 SAFETY ASSESSMENT

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

## 1.5 MEETINGS

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

## 1.6 REGULATORY REQUIREMENTS

.1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

## 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 For the purposes of this project, the Contractor is assigned the role of Prime Contractor for the Work Site and shall be responsible for the safety of all persons and property on or about the Project and for ensuring that the Work is performed in accordance with all applicable safety requirements.

.2 Report all accidents to Departmental Representative immediately.

.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 Regulations.

.2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.

.3 Comply with latest Occupational Health and Safety Regulations.

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

## 1.10 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety related factor, hazard, or condition 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 POSTING OF DOCUMENTS

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

**1.12 CORRECTION OF NON-COMPLIANCE**

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

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

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

**1.13 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**

## PART 1. GENERAL

### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 At least 2 weeks prior to commencing work, Contractor shall submit the following documents to Departmental Representative for review:

.1 Erosion and Sediment Control Plan

.2 Spill Response Plan

.3 Emergency Response Plan

.4 Landscape Execution and Restoration Plan

### 1.2 NATIONAL PARKS ACT

.1 Perform Work in accordance with all ordinances and laws set out in the National Parks Act and Regulations.

.2 Refer to Parks Canada – Waterton Lakes National Park – Approved General Project Best Management Practices, February 1, 2016, V1.0, as attached in Appendix A.

### 1.3 CANADIAN ENVIRONMENTAL ASSESSMENT ACT

.1 Execution of Work is subject to provisions within the Canadian Environmental Assessment Act.

.2 Failure to comply with or observe environmental protection measures, as identified in these specifications, may result in work being suspended pending rectification of problem(s) at the Contractors expense.

### 1.4 MIGRATORY BIRDS ACT

.1 Refer to WLNP General Project BMP document, Section 8 Vegetation Removal Mitigations Module.

.2 All tree removal shall comply with Migratory Birds Act.

.3 Avoid construction activities which affect nesting birds.

.4 Any trees required to be cut must be inspected for nesting birds and roosting bats by a qualified professional, to be approved by Departmental Representative. Trees found to have nesting birds or roosting bats are not to be disturbed until the tree is permanently vacated.

### 1.5 RELICS AND ANTIQUITIES

.1 Give immediate notice to the Departmental Representative if evidence of archaeological findings are encountered during construction, and await Departmental Representative's written instructions before proceeding with work in the immediate area of the discovery. Work in other areas can continue.

.2 Relics, antiquities, items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found onsite shall remain property of Parks Canada Agency. Protect such articles and request directives from Departmental Representative.

.3 Provide 48 hours' notice to Departmental Representative prior to commencing any work that may interfere with or affect an identified historical or archaeological site. Commence work only upon written instructions from Departmental Representative.

**1.6 WILDLIFE**

.1 Avoid or terminate activities on site that attract or harass wildlife.

.2 Immediately notify Departmental Representative of any predator sightings, activity or encounters on or around the site, including bears, wolves and cougars. The Departmental Representative will notify a Wildlife Conflict Specialist or Environmental Surveillance Officer as appropriate. Other wildlife encounters should be reported within 24 hours (other than common small birds and mammals).

**1.7 FIRES**

.1 Fires of any kind, including campfire or general burning of rubbish, is not permitted within the Townsite.

**1.8 DISPOSAL OF WASTE**

.1 Refer to WLNP General Project BMP document, Section 7 General Activities Mitigations Module.

.2 All garbage must be stored and handled in accordance with National Parks Garbage Regulations.

.3 All domestic garbage shall be stored over the short term in wildlife-proof dumpsters. Domestic recycling should be put in appropriate facilities. Contaminated materials are to be taken out of the Park for disposal.

.4 Do not bury rubbish and waste materials on site.

.5 Maintain the site in a tidy condition, free of waste material, debris and litter.

.6 All waste must be removed from the Park within a reasonable time or as directed by the Departmental Representative

**1.9 DRAINAGE**

.1 Refer to WLNP General Project BMP document, Section 5 Erosion and Sediment Control Plan, and Section 6 Emergency Response Plan Module.

.2 Contractor shall prepare an Erosion and Sedimentation Control (ESC) plan and submit to Departmental Representative for review prior to beginning work.

.3 Contractor shall prepare an Emergency Response Plan and submit to Departmental Representative for review prior to beginning work.

.4 Provide drainage and dewatering as necessary to keep excavations and site free from standing water.

.5 Dewatering is not permitted into any waterbody or sewer.

.6 Dewatering construction site will require a Restricted Activity Permit.

.7 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.8 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Parks Canada Agency requirements and 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.

## 1.10 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated.

.1 Locations of all trees existing on site to be surveyed prior to construction and final decisions on tree removal to be made on a case-by-case basis in the field by Departmental Representative.

.2 Trees identified as existing-to-remain within or adjacent to the limit of Work require a Tree Protection Zone (TPZ) during construction by means of a protective barrier or fencing installed by the Contractor. Refer to Tree Protection Construction detail.

.3 Approval of TPZs by PCA is required prior to commencing work.

.4 Activities which are likely to damage or destroy the tree are not permitted within the TPZ including:

.1 Parking of vehicles or machinery;

.2 Travel or operation of vehicles or machinery;

.3 Storage of equipment, materials, or stockpiles.

.5 The Contractor is responsible for damages to trees or shrubs identified as existing-to-remain within the limits of Work. Damages may include the cost of repair, removal, and replacement (at the rate of three trees replaced per one tree removed) as determined by assessment of damages by PCA. Species and installation locations for replacement trees to be approved by Departmental Representative.

.2 Where absolutely necessary to work adjacent to existing trees and shrubs, Contractor shall exercise all possible care to avoid injury to vegetation. Protect tree trunk. Where roots or limbs over 25 mm in diameter and/or bark are damaged during operations, immediately inform Departmental Representative for inspection and direction.

.3 Permits are required from Parks Canada Agency Environmental Surveillance Officer if a tree is to be removed. Contact Parks Canada Agency Environmental Surveillance Officer at
(403) 859-5140.

## 1.11 WORK ADJACENT TO WATERWAYS

.1 Refer to WLNP General Project BMP document, Section 16 Works Over or Immediately Adjacent to Water.

.2 Do not operate equipment in waterways.

.3 Do not use materials from waterway beds as a source of borrow material.

.4 Do not dump soil, gravel, waste or debris in waterways.

.5 Do not haul logs or construction materials in or through waterways.

.6 Fuelling operations and fuel storage shall be at least 100 m away from watercourses, in consultation with Park Warden Service and in accordance with BMP in Appendix A.

## 1.12 CONTRACTOR'S OPERATIONS

.1 Spill Response Plan to be approved by Departmental Representative prior to mobilizing to site.

.2 All construction equipment shall be thoroughly washed before entering Waterton National Park to eliminate all foreign material from transferring to park land.

.3 All equipment shall be inspected by Parks Canada Agency Surveillance Officer before commencing Work. Contractor shall provide 48 hours' notice prior to inspection.

.4 Confine all operations to work limits as shown on the drawings. Contractor to confirmed onsite work limits with Departmental Representative. No activities of any kind may be carried out beyond those work limits without Departmental Representative's written permission.

.5 Do not store or stockpile construction materials in trees bordering, or being preserved on site. Do not unreasonably encumber site with products.

.6 Equipment maintenance shall only be carried out in designated areas or as approved by Departmental Representative and Parks Canada Agency Environmental Surveillance Officer. Use of turnouts, campgrounds, picnic areas, work camps, etc., for equipment oil changes and other servicing will not be permitted.

.7 Used oil, filter and grease cartridges, lubrication containers and other products of equipment maintenance shall be collected and disposed of at nearest industrial waste facility.

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

.9 Provide sufficient sanitary facilities and maintain in a clean condition.

.10 Obtain permit from Parks Canada Agency Environmental Surveillance Officer for storage of fuel or other inflammable liquids. Observe all restrictions and conditions imposed by permit regarding special protection and berming to control spills and tank damage; fire protection considerations; provisions for disposal of fouled material and used petroleum products

.11 Contractor shall reasonably avoid disturbance to Ground Squirrels. If encountered, stop work in the immediate area and contact PCA Surveillance Officer for further instruction.

.12 Conduct operations at all times in such a manner as to preserve natural features and vegetation in area. Cut and fill slopes shall be blended with adjoining topography. Material from fill slopes will not be permitted to slough or roll into surrounding tree cover or to bury any plant material designated to be retained.

.13 When, in the opinion of Departmental Representative, negligence on part of Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond staked or designated work areas, Contractor shall be responsible, at his expense, for complete restoration of trees including replacement of trees, shrubs, topsoil, grass, etc. to Departmental Representative's satisfaction.

## 1.13 CONTRACTOR'S EMPLOYEE BRIEFING

.1 Conduct briefing sessions for all employees and sub-contractors highlighting the requirements of this section, including operation of equipment. Provide 48 hours' notice to Departmental Representative for any briefing sessions.

.2 Initial site meeting with Contractor, Departmental Representative, Park Project Manager and Parks Canada Agency Environmental Surveillance Officer will occur prior to construction commencing.

.3 Contract documents have been developed in accordance with Parks Canada Waterton Lakes National Park Approved General Project Best Management Practices screening requirements, as provided in Appendix A. Construction methods which are directly affected by BMP screening will be reviewed at initial site meeting. Contractor will be expected to comply with and ensure construction practices meet the BMP Standards. Failure to comply may lead to cessation of work.

**1.14 COMPLIANCE WITH PARKS CANADA AGENCY DEVELOPMENT PERMIT**

.1 Read, understand and comply with Parks Canada Agency Development Permit and all stipulations provided therein.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) and Alberta Building Code including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed Parks Canada Waterton Lakes National Park Approved General Project Best Management Practices.

.3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.

### 1.2 NATIONAL PARKS ACT

.1 Perform Work in accordance with National Parks Act.

.2 Obtain Demolition Permit and other applicable permits for all activities, including but not limited to:

.1 Demolition and removal of Bathroom #5 and the storage and electrical buildings adjacent to Bathroom #6;

.2 Relocation of Kithchen #4 and #13 including construction of new foundations;

.3 Tree removals;

### 1.3 OCCUPATIONAL HEALTH & SAFETY

.1 Comply with Federal, Provincial and Municipal OHS codes, regulations and guidelines.

.2 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada and Health and Welfare Canada.

### 1.4 TOWN OF WATERTON BYLAWS

.1 Comply with all municipal bylaws.

## PART 2. PRODUCTS

### 2.1 NOT USED

## PART 3. EXECUTION

### 3.1 NOT USED

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION OF SCOPE

.1 The Contractor is wholly responsible for quality of Material and Product which he provides for the Work.

.2 The Contractor is responsible for quality control testing and shall perform such inspections and tests as necessary to ensure that the Work conforms to the requirements of the Contract Documents at no extra cost to Parks Canada Agency. Cost of quality control testing shall be incidental to installation cost.

.3 During the progress of the Work, a sufficient number of tests shall be performed by the Contractor to determine that Material, Product and installation meet the specification and standard requirements.

.4 Minimum requirements regarding quality control are specified in various sections of the specifications, however, the Contractor shall perform as many inspections and tests as are necessary to ensure that the Work conforms to the requirements of the Contract Documents.

.5 Testing shall be in accordance with pertinent codes and regulations and with selected standards of the American Society for Testing Materials (ASTM) and Canadian Standards Association (CSA).

.6 Product testing, mill test and laboratory reports to demonstrate that Product and Material supplied by the Contractor meet the specifications are specified under various sections of the Contract Documents.

.7 Within 14 days of award the Contractor will submit a Quality Control Plan which will indicate the Quality Control activities and tests that the contractor will do through the course of the work including a list of tests to be completed, associated frequencies and governing standards, as well as the method and frequency of submission to test results.

### 1.2 QUALITY CONTROL

.1 The Contractor shall retain the services of a licenced independent testing agency under supervision of a registered professional Engineer, and pay for the cost of testing services for quality control including, but not limited to, the following:

.1 Sieve analysis of sands and aggregates to be supplied for the Work;

.2 Concrete field and lab testing;

.3 Asphalt field and lab testing;

.4 Backfill, subgrade, base course and asphalt compaction testing;

.5 Any product testing that is required and is specified under various sections of the specifications

.2 The Contractor shall promptly process and distribute all required copies of test reports and test information and related instructions to all of his Subcontractors and Suppliers to ensure that all necessary retesting and replacement of construction can proceed without delay.

### 1.3 QUALITY ASSURANCE

.1 Departmental Representative shall inspect and test Materials, Products and the Work for conformance with the test requirements of the Contract Documents; however, they do not

undertake to check the quality of the Work on behalf of the Contractor nor to provide quality control.

.2 Inspections and testing by the Departmental Representative do not relieve the Contractor of his responsibility to supply Materials and Products and to perform the Work in accordance with the requirements of the Contract Documents.

.3 The Departmental Representative, at his discretion, may order or perform any additional inspections and tests for purposes of his own or for purposes of Parks Canada Agency.

.4 The Contractor shall coordinate with the Departmental Representative the scheduling of testing and inspection by the Departmental Representative, to enable testing to be done as necessary, without delay, and the Contractor shall notify in writing the Departmental Representative minimum one week in advance of operations to allow for such inspection and test by the Departmental Representative's testing agency. Coordination shall include providing equipment and safe access necessary to perform testing and inspections (i.e. trench box, loaded truck for proof roll, etc.)

## 1.4 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 written notice minimum one week in advance of operations 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 part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

## 1.5 ACCESS TO WORK

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

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

## 1.6 PROCEDURES

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

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

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

## 1.7 REJECTED WORK

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

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

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

**1.8 REPORTS**

.1 Submit 1 copy of inspection and test reports to Departmental Representative.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

### 1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

.3 Restore any affected areas after removal.

### 1.3 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water. Do not pump into adjacent water courses or sewers.

### 1.4 WATER SUPPLY

.1 Contractor will provide continuous supply of potable water to all facilities outside of construction boundary.

.2 Arrange for tie-in with appropriate utility owner and pay costs for connection.

.3 Costs for any temporary water services are considered incidental to the work and no separate or additional payment will be made.

### 1.5 SANITARY SEWER

.1 Contractor will provide continuous sanitary sewer operations to all facilities outside of construction boundary.

.2 Arrange for tie-in with appropriate utility owner and pay costs for connection.

.3 Costs for any temporary sanitary sewer services are considered incidental to the work and no separate or additional payment will be made.

### 1.6 ELECTRICAL

.1 Arrange for tie-in with appropriate utility company and pay costs for connection.

.2 Costs for temporary electrical services to existing buildings that must remain electrified shall be included in the Contractors overall bid price and will not be paid for separately.

## PART 2. PRODUCTS

### 2.1 NOT USED

## PART 3. EXECUTION

### 3.1 NOT USED

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

### 1.2 INSTALLATION AND REMOVAL

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

.2 Identify areas which have to be gravelled to prevent tracking of mud and get approval from Departmental Representative.

.3 Identify areas to be used for stockpiling soil and material and get approval from Departmental Representative.

.4 Indicate use of supplemental or other staging area.

.5 Provide construction facilities in order to execute work expeditiously.

.6 Remove from site all such work after use and restore the areas in their original condition.

### 1.3 SITE STORAGE/LOADING

.1 Confine work and operations of employees to areas shown on Contract Documents.

.2 Do not unreasonably encumber premises with products.

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

.4 Contractor staging and storage areas shall be approved by Departmental Representative prior to mobilization.

.5 Staging and storage areas must have suitable foundation and surface material to avoid compromising and compacting natural organic areas.

### 1.4 CONSTRUCTION PARKING

.1 Parking will be permitted onsite provided Contractors vehicles do not disrupt performance of Work or normal operations of the National Park. Contractors parking areas must be approved by Departmental Representative.

.2 Provide and maintain adequate access to project site.

### 1.5 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

### 1.6 OFFICES

.1 If required by Contract, provide office of sufficient size to accommodate required work activities of Contractor and all Sub-Contractors and Departmental Representatives. Departmental Representative to approve location of trailers.

.2 Contractor is responsible for any temporary utility connections required for site offices.

.3 Offices and trailers shall be equipped with all necessary items required to comply with Federal, Provincial and Local OHS regulations, codes and standards.

**1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE**

.1 Provide and maintain, in 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 manner to cause least interference with work activities.

**1.8 SANITARY FACILITIES**

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

.2 Post notices and take precautions as required by local health authorities.

.3 Keep area and premises in sanitary condition.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

### 1.2 GUARD RAILS AND BARRICADES

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

.2 All excavations left unattended must be barricaded or covered.

.3 Animals must not be able to gain access to open excavations.

### 1.3 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction areas as required for access to Work as per Section 01 14 00 Work Restrictions. Exceptions may be made with prior written approval from the Departmental Representative.

### 1.4 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public in accordance with Section 01 35 00 Special Procedures for Traffic Control.

### 1.5 FIRE ROUTES

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

### 1.6 PROTECTION FOR OFFSITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

## PART 2. PRODUCTS

### 2.1 NOT USED

## PART 3. EXECUTION

### 3.1 NOT USED

**END OF SECTION**

## PART 1. GENERAL

### 1.1 REFERENCES

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

.2 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

### 1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.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 disputes 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 specifications, maintain uniformity of manufacture for any particular or like item throughout building.

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

### 1.3 AVAILABILITY

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

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

### 1.4 STORAGE, HANDLING AND PROTECTION

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

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

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

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

## 1.5 TRANSPORTATION

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

## 1.6 MANUFACTURER'S INSTRUCTIONS

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

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will 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.

## 1.7 QUALITY OF WORK

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

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

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

## 1.8 COORDINATION

.1 Ensure cooperation of workers in laying out Work.

.2 Maintain efficient and continuous supervision.

## 1.9 SETTING OUT OF WORK

.1 Departmental Representative will supply horizontal and vertical reference control point benchmarks.

.2 Contractor shall set grades and layout work in detail from control points established by Departmental Representative.

.3 Contractor shall employ competent survey personnel for complete detailed layout of work and for doing survey work required to calculate quantities based on survey measurement for progress billings. Surveyor shall have experience in urban and rural field survey work, including obtaining horizontal and vertical measurements, record keeping and calculation of quantities, generally associated with 3 to 5 years minimum related experience.

.4 Contractor will be responsible for correction of any error associated with his layout.

.5 Contractor shall supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.

.6 Contractor shall supply stakes and other survey markers required for laying out the work, collecting records and quantity information.

.7 Before commencing work, the Contractor shall satisfy himself as to the meaning and correctness of all stakes, markers and grade sheets.

.8 Cost of setting out of work will not be paid for directly but shall be considered incidental to Contract unit prices tendered.

**1.10 REMEDIAL WORK**

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate 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 EXISTING UTILITIES**

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by PCA, with minimum of disturbance to Work, building occupants and pedestrian and vehicular traffic.

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

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 PROJECT CLEANLINESS

.1 Maintain work area in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at regularly scheduled times or dispose of daily.

.3 Do not burn waste materials onsite.

.4 Remove snow and ice as required. Pile snow in designated areas only.

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

.6 Provide on-site containers for collection of waste materials and debris.

.7 Waste containers must be secure and prevent animals and public from accessing.

.8 Dispose of waste materials and debris outside of National Park boundary.

### 1.2 FINAL CLEANING

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

.2 Remove waste products and debris, and leave Work clean and suitable for occupancy.

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

.4 Sweep clean and wash exterior sidewalks, steps and surfaces; rake clean other surfaces of grounds.

.5 Mop clean and wipe down any interior areas affected by the work.

.6 Remove dirt and other disfiguration from exterior surfaces.

.7 Sweep and wash clean paved areas.

### 1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

## PART 2. PRODUCTS

### 2.1 NOT USED

## PART 3. EXECUTION

### 3.1 NOT USED

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 This schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects, including:

.1 Diversion of Materials.

.2 Waste Audit (WA) - Schedule A.

.3 Waste Reduction Workplan (WRW) - Schedule B.

.4 Demolition Waste Audit (DWA) - Schedule C.

.5 Cost/Revenue Analysis Workplan (CRAW) - Schedule D.

.6 Materials Source Separation Program (MSSP).

.7 Canadian Governmental Responsibility for the Environment Resources – Schedule E.

### 1.2 DEFINITIONS

.1 Demolition Waste Audit (DWA): Relates to actual waste generated from project.

.2 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.3 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.

.4 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

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

.6 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.7 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.8 Separate Condition: Refers to waste sorted into individual types.

.9 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

### 1.3 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by authorities having jurisdiction.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations. Containers shall be clearly marked.

.6 Locate separated materials in areas which minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

.1 Transport to recycling facility.

## 1.4 STORAGE, HANDLING AND PROTECTION

.1 Unless specified otherwise, all materials designated for demolition or removal become Contractor's property.

.2 Protect, stockpile, store and catalogue salvaged items.

.3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to approved local facility.

.4 Protect structural components not removed for demolition from movement or damage.

.5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Department having jurisdiction.

.6 Protect surface drainage, mechanical and electrical from damage and blockage.

.7 Separate and store materials produced during dismantling of structures in designated areas.

.8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On-site source separation is recommended.

## 1.5 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of any waste into waterways sewer systems.

.3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

## 1.6 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Provide security measures approved by Departmental Representative.

## 1.7 SCHEDULING

.1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

## PART 2. PRODUCTS

### 2.1 NOT USED.

## PART 3. EXECUTION

### 3.1 APPLICATION

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

### 3.2 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean area as work progresses.

.3 Sort separate materials to be reused/recycled into specified areas.

### 3.3 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative and consistent with applicable fire regulations.

.1 Mark containers or stockpile areas.

.2 Provide instruction on disposal practices.

.2 On-site sale or distribution of salvaged materials to third parties is not permitted. Demolition Waste:

| Demolition Waste | | |
|---|---|---|
| **Material Type** | **Recommended Diversion (%)** | **Actual Diversion %** |
| Pipes | 100 | |
| Valves and fittings | 100 | |
| Electrical Equipment | 80 | |
| Asphalt | 100 | |
| Metal | 100 | |
| Rubble | 100 | |
| Wood (uncontaminated) | 100 | |
| Other | 100 | |
| | | |

| Construction Waste | | |
|---|---|---|
| **Material Type** | **Recommended Diversion (%)** | **Actual Diversion %** |
| Cardboard | 100 | |
| Plastic Packaging | 100 | |
| Rubble | 100 | |
| Steel | 100 | |
| Wood (uncontaminated) | 100 | |
| Other | 100 | |

**SCHEDULE A - Waste Audit (WA)**

| Material Category | Material Quantity (unit) | Estimated Waste (%) | Total Waste Quantity (units) | Generation Point | Recycled % | Reused % |
|---|---|---|---|---|---|---|
| Wood and Plastics Material - Description | | | | | | |
| Off cuts | | | | | | |
| Warped pallets | | | | | | |
| Forms | | | | | | |
| Plastic Packaging | | | | | | |
| Cardboard Packaging | | | | | | |
| Doors / Windows | | | | | | |
| Painted frames | | | | | | |
| Glass | | | | | | |
| Wood | | | | | | |
| Metals | | | | | | |
| Others | | | | | | |

**SCHEDULE B – Waste Reduction Workplan (WRW)**

| Material Category | Person Responsible | Total Quantity of Waste (unit) | Actual Reused Amount (unit) | Actual Recycled Amount (unit) | Material Destination |
|---|---|---|---|---|---|
| Wood and Plastics Material | | | | | |
| Chutes | | | | | |
| Warped Pallets | | | | | |
| Plastic Packaging | | | | | |
| Forms | | | | | |
| Pallets | | | | | |
| Painted frames | | | | | |
| Glass | | | | | |
| Wood | | | | | |
| Metals | | | | | |
| Others | | | | | |

**SCHEDULE C – Demolition Waste Audit (DWA)**

| Material Description | Quantity | Unit | Total | Volume | Weight | Remarks and Assumptions |
|---|---|---|---|---|---|---|
| Wood, Plywood | | | | | | |
| Pipes | | | | | | |
| Valves and fittings | | | | | | |
| Electrical Equipment | | | | | | |
| Asphalt | | | | | | |
| Metal | | | | | | |
| Rubble | | | | | | |
| Wood (uncontaminated) | | | | | | |
| Others | | | | | | |

**SCHEDULE D – Cost / Revenue Analysis Workplan (CRAW)**

| Material Description | Quantity (unit) | Volume (cumulative) | Weight (cumulative) | Disposal Cost/Credit $(+/-) | Category Sub Total $(+/-) |
|---|---|---|---|---|---|
| Wood, Plywood | | | | | |
| Wood, Plywood | | | | | |
| Pipes | | | | | |
| Valves and fittings | | | | | |
| Electrical Equipment | | | | | |
| Asphalt | | | | | |
| Metal | | | | | |
| Rubble | | | | | |
| Wood (uncontaminated) | | | | | |
| Others | | | | | |

## 3.4 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

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

| Province | Address | General Inquires | Fax |
|---|---|---|---|
| Alberta | Alberta Environmental Protection<br>Petroleum Plaza, South Tower<br>9915 - 108 th Street Edmonton AB<br>T5K 2G8 | 403-427-2739 | |
| | Alberta Special Waste Management Corporation Pacific Plaza, Suite 610<br>10909 Jasper Avenue NW Edmonton AB T5J 3L9 | 403-422-5029 | 403-428-9627 |

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: Contractor shall conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Departmental Representative's inspection.

.2 Departmental Representative's Inspection:

.1 Departmental Representative and Contractor to conduct joint inspection the Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: Submit written certificates that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, adjusted and fully operational.

.4 Certificates required by Utility companies: submitted.

.5 Operation of systems: demonstrated to Parks Canada Agency personnel.

.6 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.

.2 If Work is incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of Parks Canada Agency acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment:

.1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting one week prior to contract completion with Departmental Representative, to:

.1 Verify Project requirements.

.2 Review warranty requirements.

.2 Departmental Representative to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 One week prior to Substantial Performance of the Work, submit to the Departmental Representative, two final copies of operating and maintenance manuals in English.

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

### 1.3 FORMAT

.1 Organize data as instructional manual.

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

.3 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

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

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

.6 Text: manufacturer's printed data, or typewritten data.

.7 Drawings: provide with reinforced punched binder tab.

### 1.4 AS-BUILT DOCUMENTS AND SAMPLES

.1 Maintain, at site for Departmental Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

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

## 1.5 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on construction drawings provided by Departmental Representative.

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

.3 Record information concurrently with construction progress.

.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.3 Field changes of dimension and detail.

.4 Changes made by change orders.

.5 Details not on original Contract Drawings.

.6 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

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

.7 Provide digital photos, if requested, for site records.

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SUMMARY

.1 Section Includes

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements for Installation Verification and Performance Verification of components, equipment, sub-systems, systems, and integrated systems.

### 1.2 COMMISSIONING INTENT

.1 Undertake Commissioning to bring the facility to a fully operational state and free of deficiencies in the most effective and timely manner available, ensuring the design intent is met by all systems.

.2 Commissioning incorporates inspection and quality assurance activities as construction progresses, including start up, installation verification, Performance Verification, fine tuning, and operator training.

.3 Bear all costs associated with the required personnel and test equipment as outlined in specification sections and Commissioning Manual as supplied by Contractor and all costs with organizing and managing the activities of the applicable subtrades as identified in this section.

.4 Fully document all tests and inspections performed during the construction, at start up, installation verification and Performance Verification and fine tuning. Incorporate into final commissioning documentation.

.5 Provide direct training to designated staff responsible for the operation and maintenance of the building equipment and systems.

### 1.3 RELATED SECTIONS

.1 Section 01 43 00 - Quality Control.

.2 Section 01 77 00 - Closeout Procedures.

.3 Section 01 78 00 - Closeout Submittals.

### 1.4 COMMISSIONING OVERVIEW

.1 Commissioning is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished project.

.2 Commissioning is an intensive quality assurance process that begins at the beginning of the project and continues through to the warranty period. The process focuses upon verifying and documenting that the systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the contract requirements.

.3 Commissioning activities supplement field quality and testing procedures described in each relevant technical sections.

.4 Commissioning identifies issues in Planning and Design stages which are addressed during Construction and Commissioning stages to ensure the systems are constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Commissioning activities include transfer of critical knowledge to facility operational personnel.

.5 Complete inspection and verification activities as required by the specifications and Commissioning Manual as construction progresses.

.6 Contractor's responsibility is to:

.1 Prepare and review the commissioning plan with the project team.

.2 Prepare test and verification forms as part of the commissioning plan.

.3 Complete all items as identified in the commissioning plan. This includes work by subcontractors, test agencies, equipment representatives and manufacturer agents.

.4 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with the Contract Documents.

.5 Correct deficiencies resulting from installation and Performance Verifications.

.6 Test all systems installed and address all deficiencies.

.7 Submit the completed manual and project record documents as specified.

.8 Update the documentation manuals prior to commissioning meeting.

.7 The Substantial Completion Certificate will not be issued until the commissioning process is completed and the final reports and commissioning documentation are received.

.8 The Commissioning plan provides direction for the commissioning process and provides resolution for issues such as scheduling, roles and responsibilities, lines of communication and reporting, approvals and coordination.

## 1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 During commissioning, should equipment, system components, and associated controls be identified as incorrectly installed, malfunctioning or not performing as per specifications, the contractor shall correct deficiencies, re-verify equipment and components within the system, including related systems as deemed necessary by Departmental Representative, to ensure effective and accurate operation.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor.

## 1.6 CONFLICTS

.1 Report conflicts between requirements of this section, other sections, and the Commissioning plan to the Departmental Representative to obtain clarification prior to the start of work.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

## 1.7 SUBMITTALS

.1 Prior to starting commissioning, the Contractor shall provide a set of equipment and system submittals. These submittals are supplemented by the installation and start-up procedures, O&M data, performance data, control drawings and any changes that may affect commissioned systems.

.2 Submit no later than four (4) weeks after award of Contract:

.1 Name of Contractor's commissioning coordinator.

.2 Preliminary commissioning schedule. Submit final Commissioning schedule to Departmental Representative for review prior to Performance Verification.

.3 Submit the names of all personnel for approval by the Departmental Representative. Designate who has managerial responsibilities for coordination of installation verification and Performance Verification.

.4 Submit documentation to confirm personnel compliance with quality assurance provisions.

.3 Any changes to the information submitted must be re-submitted. Ensure certified trades persons, certified testing agencies and/or factory authorized personnel participate in commissioning tasks.

.4 Prior to start of Performance Verification:

.1 Submit start-up documentation to Departmental Representative for review.

.2 Submit completed Installation Verification checklists.

.5 Fifteen (15) days prior to application for Substantial Completion:

.1 Submit three (3) copies of final commissioning plan and applicable forms to the Departmental Representative for review.

.2 Submit reports of Performance Verifications postponed due to seasonal, climatic, occupancy, or other reasons beyond the Contractor's control, promptly after execution of those services.

.6 Ensure each form bears the required signatures as indicated on the form.

.7 Submit as-built drawings, schematics, O&M manuals, maintenance materials and warranties to Departmental Representative for review.

## 1.8 COMMISSIONING DOCUMENTATION

.1 Checklists will be provided to the Contractor by the Departmental Representative during the construction stage for review.

.2 The general contractor is to submit completed checklists to the Departmental Representative for review and acceptance.

.3 Once all documents have been reviewed and accepted, the general contractor shall submit final commissioning documents in electronic form (PDF) and original signed copies.

## 1.9 COMMISSIONING SCHEDULE

.1 Submit preliminary commissioning schedule in Gantt Chart format to Departmental Representative no later than four (4) weeks after award of contract. A sample commissioning Schedule is provided in the commissioning plan.

.2 Submit final commissioning schedule in Gantt Chart format to Departmental Representative for review four (4) weeks prior to Performance Verification.

.3 Provide adequate time for commissioning activities prescribed in the commissioning plan including all on site activities as well as documentation procedures. Time should be allowed for re-verification should any system be rejected upon completion of initial verification.

.4 Provide adequate time for training.

## 1.10 COMMISSIONING MEETINGS

.1 The contractor will convene commissioning meeting consisting of all members of the design and construction teams to address the systems to be commissioned. Items to be

discussed will include commissioning requirements, completion and start-up schedules, and roles and responsibilities.

.2 Convene commissioning meetings following project meetings and as specified herein to resolve issues, monitor progress and identify deficiencies relating to Commissioning.

.3 Continue commissioning meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage Departmental Representative to call a separate Commissioning meeting to review progress, discuss schedule of equipment start-up activities and prepare for Commissioning. Issues at meeting to include:

.1 Review duties and responsibilities of contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter commissioning meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meetings will be chaired by the Departmental Representative; meeting minutes will be prepared and issued by the Departmental Representative. Clarifications to the minutes must be submitted within 5 days of issue, after which, the issued set becomes the official project record.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Commissioning meetings and as required.

## 1.11 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections, including disassembly and re-assembly after approval, starting, testing and adjusting, and supply of testing equipment, and all associated costs of installation and performance verification.

## 1.12 WITNESSING OF STARTING AND TESTING

.1 Provide ten (10) days' notice prior to commencement.

.2 Departmental Representative to witness start-up and testing.

.3 Contractor's to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

## 1.13 MANUFACTURER'S INVOLVEMENT

.1 The Contractor shall obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.2 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.3 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 Ability to report results in clear, concise, logical manner.

## 1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting performance verification.

.2 Conduct Commissioning in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of product information report forms.

.2 Visual inspection of quality of installation.

.2 Installation Verification: follow accepted start-up procedures.

.3 Performance Verification: document equipment performance. Include repetition of tests after correcting deficiencies.

.4 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document required tests on checklists provided in the Commissioning plan as well on any supplied manufacturer forms.

.5 Failure to follow accepted commissioning processes will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment commissioning process was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.

.2 Major equipment/systems: If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment to be removed from site and replaced with new.

.3 Subject new equipment/systems to specified commissioning process

## 1.15 COMMISSIONING DOCUMENTATION

.1 Assemble Installation Verification documentation and submit to Departmental Representative for approval before commencement of performance verification.

.2 Installation Verification documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Inspection and material tests reports.

.3 Signed Installation Verification check lists.

.4 Start-up reports.

.5 Step-by-step description of complete start-up procedures, to permit the contractor or Departmental Representative to repeat start-up at any time.

## 1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After Performance Verification, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit to Departmental Representative for approval before implementation.

.3 After completion of commissioning, operate and maintain systems until issuance of Substantial Completion

## 1.17 TEST RESULTS

.1 If start-up, testing and/or performance verification produce unacceptable results, repair, replace or repeat specified starting and/or performance verification procedures until acceptable results are achieved.

.2 Provide personnel, resources and materials, assume all costs for re-verification.

## 1.18 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide all required equipment to complete commissioning.

.3 Provide all Arc Flash Personal Protective Equipment as required. Provide commissioning personnel with the appropriate Arc Flash Protection training.

## 1.19 PERFORMANCE VERIFICATION

.1 Notify Departmental Representative at least ten (10) days prior to start of performance verifications.

.2 Start Performance Verification after elements of site affecting start-up and Performance verification of systems have been completed.

.3 Notwithstanding all-inclusive requirements specified in this section, additional separate commissioning may be required at a later date for equipment and systems whose full operation is dependent on seasonal conditions. Job conditions for Peak Performance Verification are as follows:

.1 Summer sequence commissioning to take place between June 1$^{st}$ and September 15$^{th}$ when outside ambient temperatures are at least 22°C;

.2 Winter sequence commissioning to take place between November 1$^{st}$ and March 31$^{st}$ when outside ambient temperature is no greater than minus 10°C.

.4 Commissioning procedures to be repeatable and reported results are to be verifiable.

.5 Follow equipment manufacturer's operating instructions.

.6 Contractor to obtain all documentation, including updated points list, controls sequences and setpoints, and submit documentation to Departmental Representative for review. At completion of commissioning, scan completed manuals to electronic format on CD(s) in PDF format as required and submit to Departmental Representative.

## 1.20 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

## 1.21 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 If the Departmental Representative is not available to witness, the certificates of approval from the Authority Having Jurisdiction will be accepted as adequate.

.3 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.4 Provide copies to Departmental Representative within five (5) working days of test and with commissioning report.

## 1.22 REPEAT VERIFICATIONS

.1 Assume costs incurred by Parks Canada Agency for second and subsequent verifications where:

.1 Verification of reported results fails to receive Departmental Representative's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems contractor's request for second verification was premature.

## 1.23 DEFICIENCIES, FAULTS, DEFECTS

.1 Report problems, faults or defects affecting commissioning to Departmental Representative in writing. Stop commissioning until problems are rectified. Proceed with written approval from Departmental Representative.

.2 Correct deficiencies found during start-up and commissioning to satisfaction of Departmental Representative.

## 1.24 COMPLETION OF COMMISSIONING

.1 Upon completion of Commissioning, leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities, complete commissioning prior to application for Substantial Completion.

.3 Commissioning to be considered complete when all commissioning deliverables have been submitted and accepted by Departmental Representative.

.4 The contractor shall compile a Final Commissioning Report summarizing all tasks, findings and documentation of the commissioning process. The Final Commissioning Report is to incorporate all test reports by sub-contractors, manufacturer's and controlling authorities including the following list. The Contractor shall turn over all materials per this specification.

.1 Evaluation of operating condition of the systems at the time of functional test completion.

.2 Deficiencies that were discovered and measures taken to correct them.

.3 Functional test procedures and results.

.4 Documentation of all commissioning field activities as they progressed.

.5 Description and estimated schedule of required deferred testing.

.5 The Contractor to provide O&M manuals, maintenance materials, warranties and training records.

**1.25 ACTIVITIES UPON COMPLETION OF COMMISSIONING**

.1 When changes are made to baseline components or system settings established during commissioning process notify Departmental Representative.

**1.26 TRAINING**

.1 Contractor shall provide training to Parks Canada Agency Staff on all new installed systems during commissioning stages to familiarize Parks Canada Agency Operations and Maintenance team with the systems.

.2 Contractor shall provide two sessions to train the Parks Canada Agency Operations and Maintenance team on the new systems.

.3 Training material shall include:

.1 Commissioning Plan

.2 Operations and Maintenance Manual

.3 As-built Records.

.4 Training instructors shall be certified by the system manufacturer.

**1.27 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS**

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract. Provide transmittal documenting all materials provided.

**1.28 PARKS CANADA AGENCY PERFORMANCE TESTING**

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

**PART 2. PRODUCTS**

**2.1 NOT USED**

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies requirement for selective demolition of buildings, surface works, utilities and related infrastructure as described.

### 1.2 RELATED WORK

.1 01 35 29 Health and Safety Requirements

.2 01 35 43 Environmental Procedures

.3 01 41 00 Regulatory Requirements

.4 01 56 00 Temporary Barriers and Enclosures

### 1.3 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

.1 The location and elevation of existing underground utilities is compiled from records, if available, but is not guaranteed. Notwithstanding any other provision, the Contractor shall be responsible for determining at his expense the actual location and elevation of all sewer, water and gas mains or lines, electric light, power, telephone or telecommunications, conduits, or other such structures or utilities whether or not shown on the plans. The Contractor shall be responsible for notifying the respective utility at least forty-eight (48) hours in advance of his intention to carry out operations in the vicinity of the said utility and, if required, shall pay for any service supplied for locating of these utilities.

.2 No extra payment will be provided for crossing existing utilities or for special supports for pipelines, cables or poles, or any hand excavation that may be necessary.

.3 If it is necessary to relocate utilities, including poles, because of conflicts with the proposed work, then Parks Canada Agency will be responsible for the payment of the utility relocation. Coordination of the relocation shall be conducted by the Contractor at no cost to Parks Canada Agency.

.4 If it is necessary to relocate utilities, including poles, or structures only to accommodate the Contractor's construction procedure or method, the Contractor shall be responsible for payment of all costs incurred.

.5 Where Work involves breaking into or connecting to existing utilities, carry out work at times directed by the Owner, with minimum of disturbance to users of the services, pedestrian and vehicular traffic.

.6 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active utility service or facility. Adhere to approved schedule and provide notice to affected parties.

.7 Where unknown utilities are encountered, immediately advise Departmental Representative and confirm findings in writing.

.8 Record locations of maintained, re-routed and abandoned utilities indicating horizontal distances and vertical elevations.

.9 Inspect all existing underground and surface structures prior to the commencement of construction or demolition, and bring to the attention of the appropriate authority and the Departmental Representative all existing damages. Prior to issuance of the Final Acceptance Certificate, the Contractor shall be responsible for payment for repairs or replacement to correct subsequent damages which may occur.

## 1.4 GENERAL REQUIREMENTS

.1 Ensure all Work is performed in accordance with all applicable Federal, Provincial and local regulations, codes and guidelines.

.2 Notify and obtain written approval of utility companies before starting demolition. Provide proof of notification and approval to Departmental Representative prior to performing Work.

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

.4 Do not interfere with use of adjacent existing buildings and infrastructure to remain in use. Maintain free and safe passage from adjacent infrastructure.

.5 Carry out demolition in an orderly and careful manner using tradesmen qualified to perform demolition and removal work.

.6 Completely demolish the items indicated and as required to accommodate new Work, and remove all resulting materials from the premises, except as noted otherwise.

.7 Selling or burning materials onsite in not permitted.

.8 Where unexpected conditions and/or hazardous materials are encountered during demolition, stop work in the area immediately and notify the Departmental Representative and follow all instructions.

.9 Remove all piping, electrical wiring and foundations. Completely remove existing buildings as indicated.

.10 Building utilities are to be capped two metres away from buildings demolished.

.11 Demolish foundation walls, footings and concrete floors below or on grade to make way for new construction.

.12 Do not use concrete or masonry debris as backfill.

## 1.5 HAZARDOUS MATERIALS ASSESSMENT

.1 Contractor shall refer to Pre-Demolition Hazardous Materials Assessment prepared by Alberta Safety & Environmental Services Ltd. dated June 19, 2017, herewith included in Appendix B, and adhere to recommendations provided therein.

.2 No liability is assumed by Parks Canada Agency or Departmental Representatives for the exactness and completeness of the report.

.3 Contractor shall make additional examination of the site as they feel necessary in order to satisfy themselves as to the conditions to be encountered and report any irregularities or changes to Departmental Representative.

# PART 2. PRODUCTS

## 2.1 EQUIPMENT

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

.2 Select such type of equipment for demolition to minimize damage to site and disruption to adjacent areas.

## PART 3. EXECUTION

### 3.1 PREPARATION

.1 Inspect site with 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. Preserve active utilities traversing site in operating condition.

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

.4 Disconnect water, sewer, electrical, communications and/or any other services.

### 3.2 REMOVAL OF HAZARDOUS WASTES

.1 Contractor shall dispose of all demolition materials outside of Waterton Lakes National Park and in accordance with Federal, Provincial and local regulations, codes and standards.

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

### 3.3 UTILITY REMOVALS

.1 Contractor shall remove and/or decommission in-place all existing water, sewer and electrical items as described in the Contract and shown on the construction drawings.

.2 Refer to Electrical Specifications and construction drawings for electrical decommission works.

.3 Departmental Representative shall be notified immediately of any discrepancies for clarification prior to disturbing utility.

.4 Water and sewer pipes shown on the construction drawings as requiring decommissioning shall be fully removed when encountered within the trench zone. Open pipe ends shall be filled with native soil material to reduce potential for collapse and subsurface water movement in abandoned pipes.

.5 Pipes to be decommissioned, which will not be exposed in the trench zone, do not require full removal, however the limits of pipe remaining in the ground must be accurately recorded by the Contractor as abandoned and provided to the Departmental Representative as part of the as-built drawing mark-ups.

.6 Valves which are to be decommissioned shall left in the closed position and valve stem removed from at least within 1 metre of the finished surface.

.7 All manholes and septic tanks which are to be decommissioned shall be demolished and fully removed. Exposed pipe ends shall be filled with native granular material.

.8 Existing campsite and building service connection pipes shall be fully removed from within trench zones and abandoned in-place where not exposed. Open pipe ends do not require concrete or granular fill.

.9 Existing water and sanitary service fixtures (standpipes and sanitary dump receptacles) at all campsites shall be fully removed and disposed of accordingly.

.10 Existing fire hydrants shall be removed from at least within 1 metre of finished surface.

.11 All waste material produced from decommissioning utilities is the responsibility of the Contractor and shall be disposed of outside of Waterton Lakes National Park.

.12 All costs associated with decommissioning existing utilities shall be incidental to the Work and no separate payment will be made.

## 3.4 SURFACE WORKS REMOVALS

.1 Remove items as indicated and do not disturb items designated to remain in place.

.2 Removal of pavements, curbs, gutters, sidewalks and pads:

.1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.

.2 Protect adjacent joints and load transfer devices.

.3 Protect underlying and adjacent granular materials.

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

.4 Remove designated trees during demolition.

.1 Obtain written approval of Departmental Representative prior to removal of trees not designated.

.5 Stockpile topsoil for final grading and landscaping at locations approved by the Departmental Representative.

.1 Stockpile location at Red Rock SMS approximately 6 km from site.

.2 Provide erosion and sediment control.

.6 Materials which are not contaminated may be eligible for stockpiling within the Park depending on volume and type of material, with Departmental Representative approval. Long term stockpiling will require cover material, such as tarp or seeding.

.7 Disposal of Material:

.1 Dispose of materials not designated for salvage to approved disposal facility outside of National Park or reuse on site as instructed by Departmental Representative.

.8 Backfill:

.1 Backfill in areas as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.9 Remove timber roadside bollards, post and beam fencing, and sign posts as identified on the drawings and in the field in conjunction with Departmental Representative. Timber proposed for re-use shall be inspected and approved by Departmental Representative prior to re-use, otherwise, all proposed timber materials must be new.

## 3.5 STOCKPILING

.1 Stockpile in designated areas only and install temporary sign or label to indicate material type and associated project, if stockpiled offsite.

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

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

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

.5 For stockpiles that will be in place for an extended duration, take appropriate measures to limit and protect stockpile from the effects of erosion and extreme weather. Refer to Appendix A Parks Canada Waterton Lakes National Park – Approved General Project Best Management Practices.

.6 The Contractor is authorized to use the Red Rock SMS area for temporary stockpiling, processing and sorting materials. The Contractor shall provide the Departmental Representative with a complete topographic survey of the entire laydown area prior to mobilizing equipment and materials to the site, and provide a subsequent survey of the same area after clean-up and site restoration for verification.

## 3.6 RESTORATION

.1 Restore areas disturbed by the new works to match condition of adjacent, undisturbed areas and as specified by Departmental Representative.

.2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, water courses or ground water.

.3 The Red Rock SMS area shall be restored to a similar, or better condition, upon project completion. The final condition of the area shall be reviewed and approved by the Departmental Representative prior to Contractor demobilization.

.4 The Contractor is advised the access road to the Red Rock SMS area is typically included in the local 70% load restriction road bans during spring thaw. Contractor shall plan and coordinate hauling activities to accommodate reduced load capacities. Damage incurred by the access road due to the Contractors activities shall be rehabilitated to the satisfaction of the Departmental Representative.

## 3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Remove debris, trim surfaces and leave work site clean, upon completion of Work

.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

## 3.8 PROTECTION

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

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Methods for removal of existing asphalt pavement.

## PART 2. PRODUCTS

### 2.1 EQUIPMENT

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

.2 Haul routes must be approved by Departmental Representative.

.3 Contractor shall consider 60% restricted road ban during spring seasons.

## PART 3. EXECUTION

### 3.1 PREPARATION

.1 Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed. Areas to be removed shall be clearly marked out onsite with paint and approved by the Departmental Representative prior to saw cutting.

.2 Milled material shall be made suitable for use as granular base material for road and gravel structures.

.3 Milled material shall be stockpiled and processed at the Red Rock SMS area.

### 3.2 PROTECTION

.1 Protect existing pavement not designated for removal and utility infrastructure from damage. Asphalt to be removed adjacent to pavement to be left in place must include saw cutting to preserve the intact pavement.

.2 In event of damage, immediately replace or make repairs to approval of Departmental Representative at no additional cost.

### 3.3 REMOVAL

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

.2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.

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

.4 Any contaminated asphalt will not be allowed for reuse or stockpiling within the Park.

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

.6 Asphalt removed areas under public traffic use will require temporary ramping and signage at transition areas until the area is restored.

.7 Appendix C contains numerous asphalt cores with estimated pavement depths conducted in 2015 and is provided to the Contractor for general information only.

Contractor shall make his own inspections and determination of estimated quantity removal.

## 3.4 FINISH TOLERANCES

.1 Finished surfaces in areas where asphalt pavement has been removed to be within +/-5 mm of grade specified but not uniformly high or low.

## 3.5 SWEEPING

.1 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 01 – Cast-in-place Concrete Short Form.

### 1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

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

.2 CAN/CSA-S269.3 (R2003), Concrete Formwork, National Standard of Canada

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings for formwork and falsework.

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

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121 CAN/CSA-O86 CSA O437 Series CSA-O153.

.2 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.3 Forms for Exposed Surfaces:

.1 Use 18 mm coated Formply consisting of Douglas Fir substrate with resin-impregnated paper overlay and factory treated chemically active release agent.

.2 Use full sized sheets as practical.

.3 Obtain approval of Departmental Representative prior to the reuse of any form.

.4 Support pours less than 1.5 m height at 300 mm maximum on centres.

.5 Support pours greater than 1.5 m height at 200 mm maximum on centre.

.6 Use strong-backs or walers placed perpendicular to supports to ensure straightness of form.

.7 Construct metal bolts or anchorages within the form so as to allow their removal to a depth of at least 20 mm from the concrete surface.

.8 Remove plastic sleeves for a distance of 100 mm from the face of the concrete and fill cavity with a non-shrink grout approved by the Departmental

Representative to 75 mm from the surface. Fill remaining 75 mm with approved concrete patching material.

.4 Forms for unexposed surfaces:

.1 Use 15 mm plywood supported at 400 mm maximum on centre

## 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 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.3 Fabricate and erect falsework in accordance with CSA S269.1.

.4 Do not place shores on frozen ground.

.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 CSA-A23.1/A23.2.

.6 Align form joints and make watertight.

.1 Keep form joints to minimum.

.7 Use 25 mm chamfer strips on external corners and/or 25 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.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.10 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.

.1 7 days for walls.

.2 21 days for slabs and other structural members

.2 Remove formwork when concrete has reached 80 % of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide 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.

.4 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.GENERAL.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-place Concrete

## 1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment:

.1 No measurement will be made under this Section.

.1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

## 1.3 REFERENCES

.1 ACI Detailing Manual 2004.

.2 ACI 439.3R-07, “Types of Mechanical Splices for Reinforcing Bars”.

.3 ASTM A123/A123M-12, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.4 ASTM A497/A497M–07, “Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete”.

.5 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.6 CAN/CSA-A23.3-14, Design of Concrete Structures.

.7 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

.8 CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.9 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

## 1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.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 of Alberta, 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 Departmental Representative DCC Representative Consultant, with identifying code marks to permit correct placement without reference to structural drawings.

.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

.1 Provide type B tension lap splices where indicated unless otherwise indicated.

## 1.5 QUALITY ASSURANCE

.1 Submit in accordance with Section 01 43 00 - Quality Control.

.1 Mill Test Report: provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.

.2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

**1.6 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 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: 400 MPa yield grade; deformed billet steel bars conforming to CSA-G30.18; plain finish.

.3 Weldable Reinforcing Steel: weldable low alloy deformed steel bars, conforming to CSA G30.18, Grade 400W.

.4 Galvanized Reinforcing Steel: billet steel deformed bars to CSA-G30.18 and ASTM A123/A123M.

.5 Epoxy Coated Reinforcing Steel: billet steel deformed bars to CSA-G30.18 and ASTM A775/A775M.

.6 Tie Wire: minimum 1.6 mm annealed type, or patented system approved by Departmental Representative.

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

.8 Mechanical splices: subject to approval of Departmental Representative.

**2.2 FABRICATION**

.1 Fabricate reinforcing steel in accordance with CSA-A23.1 and Drawings.

.2 Locate reinforcing splices not indicated on Drawings at points of minimum stress.

.3 Fabricate within the following tolerances:

.1 Sheared length: ±25 mm.

.2 Depth of truss bars: plus 0, minus 10 mm.

.3 Stirrups, ties and spirals: ±10 mm.

.4 Other bends: ±25 mm.

.4 Weld reinforcing bars in accordance with CSA W186.

.5 All bending shall be done cold with a suitable machine accurately producing all lengths, depths and radii shown on the bending details.

.6 Bars shall not be bent or straightened in a manner that will injure the material and any bars with kinks or bends not shown on the Drawings shall not be used.

.7 After initial fabrication, reinforcing steel shall not be re-bent or straightened unless so indicated on the Drawings.

.8 Heating of reinforcing steel will not be permitted.

.9 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.1 Ship epoxy coated bars in accordance with ASTM A775/A775M.

**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 2 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 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

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

**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 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Forming and Accessories

.2 Section 03 20 00 – Concrete Reinforcing.

### 1.2 REFERENCES

.1 CSA International

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA A23.3-14, Design of Concrete Structures

.3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 CSA A283-06, Qualification Code for Concrete Testing Laboratories

.5 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction

### 1.3 ACTION AND INFORMATION SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and necessary details of reinforcing.

.2 Submit drawings showing formwork and falsework design to: CSA A23.1/A23.2.

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

.3 Provide testing results for review by Departmental Representative and Consultant and do not proceed without written approval when deviations from mix design or parameters are found.

.4 Concrete hauling time: provide for review by Departmental Representative and Consultant deviations exceeding maximum allowable time of 120 for concrete to be delivered to site of Work and discharged after batching.

### 1.4 QUALITY ASSURANCE

.1 Provide to Departmental Representative, 2 weeks minimum prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements.

### 1.5 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 Consultant and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by the 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 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES.

### 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 Cement: to CSA A3001, Type GU.

.2 Water: to CSA A23.1/A23.2

.3 Aggregates: Fine and coarse aggregates: to CAN/CSA-A23.1, stockpiled separately.

.4 Water reducing agents and superplasticizers: to ASTM C494.

.5 Air entraining agents: to ASTM C260.

.6 Hydration stabilizing admixtures: to ASTM C494. Permitted only with written acceptance from the Departmental Representative.

.7 Curing: Portable water and/or approved curing agent.

### 2.4 MIXES

.1 Submit a concrete mix design including applicable material test reports for the Departmental Representative's review a minimum of 2 weeks before concrete placement.

.1 Mix designs:

.1 Prepared by Concrete Testing Laboratory.

.1 Laboratory certified to CAN/CSA-A283.

.2 Signed and sealed by Professional Engineer registered in the Province of Alberta employed by laboratory certified to CAN/CSA-A283.

.2 Prepared by supplier:

.1 Reviewed for compliance, signed and sealed by Professional Engineer registered in the Province of Alberta employed by an independent concrete laboratory certified to CAN/CSA-A283.

.2 Required mix properties:

.1 Minimum specified compressive strength at 28 days: 25 MPa.

.2 Nominal maximum aggregate size: 20 to 5 mm.

.3 Range of slump: 100 ± 30 mm.

.4 Maximum water/cementing materials ratio: 0.40.

.3 Material test:

.1 Fine and coarse aggregate sieve: CAN/CSA-A23.2-2A within 90 days.

.2 Amount of material finer than 80 um in aggregate: CAN/CSA-A23.2-5A within 90 days.

.3 Organic impurities in sands for concrete: CAN/CSA-A23.2-7A within 90 days.

.4 Results of deleterious substances and physical properties of aggregates: Table 12, CAN/CSA-A23.1; A23.2-3A, A23.2-4A, A23.2-23A, A23.2-24A, A23.2-29A within 180 days.

.5 Potential expansivity of aggregates: CAN/CSA A23.2-14A within 24 months.

.6 Detection of alkali-silica reactive aggregate by accelerated expansion of mortar bars: CAN/CSA A23.2-25A within 12 months.

## PART 3. EXECUTION

### 3.1 PREPARATION

.1 Provide Departmental Representative 48 hours' notice before each concrete pour.

.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 rehandling, and without damage to existing structure or Work.

.4 Protect previous Work from staining.

.5 Clean and remove stains prior to application of concrete finishes.

### 3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2 and as indicated on Drawings.

.2 Immediately before concrete is placed, all forms shall be carefully inspected to ensure that they are properly placed, sufficiently rigid and tight, and that all reinforcing steel is in the correct position and secured against movement during the placing operation. All forms shall be thoroughly cleaned and all debris, snow, ice or other foreign material removed. Chemicals shall not be used to remove ice or hardened concrete from the forms. All forms shall be thoroughly soaked with water except in freezing weather.

.3 Handling equipment shall be kept free from hardened concrete or foreign material, and cleaned at frequent intervals

.4 Ensure all anchors, seats, plates and other items to be cast into concrete are securely placed, and will not interfere with concrete placement.

.5 Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid re-handling or flowing. Vibrators shall not be used to move concrete. Under no circumstances shall the concrete which has partially hardened by deposited in the forms

.6 When concrete is started, it shall be carried on as a continuous operation until the placing of the section is completed. When shown on the Drawings, concrete shall be placed in the sections indicated and according to the sequence given.

.7 Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

.8 Ensure reinforcement, inserts, embedded parts, formed expansion and control joints and heating pipes are not disturbed during concrete placement.

.9 Prepare set concrete by removing all laitance and loose materials and applying bonding agent. Apply bonding agent in accordance with manufacturer's recommendations.

.10 Place concrete continuously between present construction and control joints.

.11 Vibrate concrete using the appropriate size equipment as placing proceeds in strict accordance with CSA-A23.1. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

.12 Where bonding a topping to previously placed substrate concrete is required, ensure that the substrate concrete surface is rough, clean and free of oil, grease, laitance and loose material such as dust and debris. Thoroughly clean the substrate and place the bonding agent to substrate immediately prior to placing the topping in accordance with the manufacturer’s recommendations.

.13 Where placing operations would involve dropping the concrete more than 1.5 meters, it shall be placed through “canvas elephant trunks” or galvanized iron chutes. Concrete levels shall not be raised at a rate greater than that for which proper vibration may be affected.

.14 The concrete surfaces shall be protected from rain until the final set occurs.

.15 A minimum of 72 hours shall elapse between adjacent pours separated by construction joints or expansion joints.

.16 Do not place concrete in the interior of a building if carbon dioxide producing equipment has been in operation in the building during the 12 hours preceding the pour. This equipment shall not be used during placing or for 24 hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or an impermeable membrane from direct exposure to carbon dioxide, combustion gases or drying from heaters.

.17 Honeycombing or embedded debris in concrete is not acceptable.

.18 Remove and replace defective concrete in accordance with Clause 3.10 of this Section

.19 Sleeves and inserts:

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.

.2 Sleeves and openings greater than 100 mm x 100 mm not indicated must be reviewed by Departmental Representative.

## 3.3 CONSTRUCTION JOINTS

.1 Joints not indicated on the Drawings shall be located so as to least impair the strength of the structure. The location of these joints shall be subject to the prior approval of the Departmental Representative. Joints shall be in accordance with CSA-A23.1 or as indicated on Drawings or as directed by the Departmental Representative.

.2 Construction joints shall be completed as follows:

.1 Reinforcement continuous through the joint.

.2 Roughen surface to a minimum 5 mm amplitude by sandblasting and/or high pressure water blasting.

.3 Where the Contractor elects to employ construction joints in the two compartment sump other than shown and the Departmental Representative so approves, waterstops shall be provided for the full length of the joint if required by the Departmental Representative and without additional compensation to the Contractor.

.4 The surface of hardened concrete shall be roughened and thoroughly cleaned of foreign matter and laitance, and shall be thoroughly wetted with water but not saturated and the forms re-tightened against the face of the hardened concrete before depositing additional concrete. Epoxy bonding agents may be required as directed by the Departmental Representative.

## 3.4 COLD AND HOT WEATHER CONCRETING

.1 Conform to requirements of CSA-A23.1.

.2 Refer to Division 1 for temporary enclosure and heating requirements.

.3 Protect slabs being finished during drying conditions above 25ºC and/or during high winds with moisture retention film.

## 3.5 CONCRETE PROTECTION FOR REINFORCEMENT

.1 Ensure reinforcement is placed to provide minimum concrete cover in accordance with CSA-A23.1 or as shown on Drawings.

## 3.6 SLAB ON GRADE AND CONCRETE INSIDE THE BUILDINGS FOOTPRINT

.1 Seal punctures and damaged areas of vapour barrier before placing concrete. Use vapour barrier material, lapped over punctures and damaged areas minimum 200 mm in all directions. Seal with tape.

.2 Place adjustable screeds at suitable locations. Do not pierce vapour barrier.

.3 Carefully place concrete to required elevations indicated on Drawings.

.4 Separate slabs-on-fill from vertical surfaces with 13 mm thick joint filler. Extend joint filler from bottom of slab to within 13 mm of finished surface.

.5 Slab finish to be a conventional smooth trowelled finish in accordance with CSA A23.1. Tolerance shall be to a floor profile quality classification, 8mm elevation difference over a 3m span.

.6 Do not sprinkle dry cement or dry cement and sand mixtures over concrete surfaces.

.7 Saw cut control joints in straight lines for slabs-on-grade, within 24 hours after finishing (green cutting is acceptable). Cut in pattern shown on Drawings. Use 5 mm thick blade, 1/3 depth of slab unless noted otherwise.

.8 Apply sealer to slab-on-grade and curbs in accordance with manufacturer's instructions. After floor treatment is dry, seal construction joints with sealant.

## 3.7 FINISHING WALKS, CURBS, RAMPS, STEPS

.1 Finish edges of curbs, walks and pads to smooth radius.

.2 On walks, tool control joints across at spacing shown on Drawings.

.3 Broom finish surface of overhead door pads, man door aprons, steps, walks, curbs and ramps.

.4 Apply curing and sealing compound to manufacturer's directions.

**3.8 FINISHES**

.1 Formed surfaces exposed to view: sack rubbed finish in accordance with CSA A23.1/A23.2.

**3.9 FIELD QUALITY CONTROL**

.1 Concrete testing: to CSA A23.1/A23.2 by testing laboratory approved by Consultant and paid for by Contractor.

**3.10 PATCHING**

.1 Allow Departmental Representative to inspect concrete surfaces immediately upon removal of all formwork.

.2 Patch imperfections when concrete is green.

.3 Remove all exposed metal form ties, nails and wires, break off fins and remove all loose concrete.

.4 Thoroughly wet all form tie pockets and patch with patching mortar followed by proper curing.

.5 Chip away honeycombed and other defective surfaces to depth of not less than 25mm with the edges perpendicular to the surface. Thoroughly wet and patch with patching mortar followed by proper curing.

**3.11 CLEANING**

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate cleaning area for tools to limit water use and runoff.

.4 Cleaning of concrete equipment to be done in accordance with Section 01 35 43 Environmental Procedures.

.1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.

.2 Provide appropriate area on job site where concrete trucks and be safely washed.

.3 Divert admixtures and additive materials from landfill to approved official hazardous material collections site after receipt of written approval from Departmental Representative.

.4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 WORK INCLUDED

.1 Removal of deteriorated concrete.

.2 Surface preparation to receive repair materials.

.3 Formwork as required.

.4 Application of repair materials as shown on Drawings or as specified elsewhere in the Contract Documents.

.5 Curing.

### 1.2 ENVIRONMENTAL CONSTRAINTS

.1 Be aware of any site/operation related environmental constraints.

.2 Debris shall be contained and disposed of to an acceptable waste site.

.3 Concrete or other repair materials shall not be allowed to enter into water channels or sewer systems.

.4 Ensure sandblasting operations meet the environmental protection requirements.

.5 Ensure satisfactory clean-up and landscape restoration.

### 1.3 QUALITY ASSURANCE

.1 The manufacturer's technical support inclusive of the on-the-job service, shall be available for all products used under this Specification.

.2 The manufacturer shall, upon request, issue product performance certificate indicating that their products conform to this specification.

### 1.4 EXAMINATION OF WORK

.1 Examine the Drawings and visit the site to determine existing conditions. Notify the Engineer, in writing, of any discrepancies between the information on the Drawings and existing conditions.

.2 Examine the existing as-constructed work. Notify the Departmental Representative, in writing, of any conditions which may prejudice proper completion of the Work. Commencement of the Work implies acceptance of existing conditions.

.3 The Departmental Representative and Contractor shall jointly inspect and mark the extent of repair work.

.4 The extent of repair work may be adjusted upon the removal of deteriorated concrete and examination of the condition by the Departmental Representative.

## PART 2. PRODUCTS

### 2.1 MATERIAL PERFORMANCE STANDARDS

.1 All materials shall be as specified on the Drawings, or as approved by the Departmental Representative.

.2 Cementitious grout shall be a Portland cement based product requiring only the addition of potable water for mixing or a polymer modified cementitious compound.

.3 Cementitious grout shall contain natural aggregates and are to be used for patches greater than 12 mm in depth.

.4 Polymer grouts shall be used for patches less than 12 mm in depth.

.5 Grout shall meet or exceed the strength requirements of 20 MPa in 1 day and 35 MPa in 3 days.

.6 Grout used to repair any newly constructed element shall meet or exceed the strength requirements of the element.

## 2.2 PRODUCT INSTALLATIONS

.1 Product shall be packaged in moisture resistant bags or containers with the product name, lot number and expiration date marked clearly on each package.

.2 Each bag or container shall be accompanied by printed instructions indicating recommended instructions for proper use of the product.

.3 Product shall be delivered without damage or contamination.

.4 Product shall be stored and protected from damage or contamination.

## 2.3 ACCEPTABLE MATERIALS (SUBJECT TO DEPARTMENTAL REP. REVIEW)

.1 Flowable Grout:

.1 Masterflow 713 by Master Builders

.2 M-Bed Superflow or Sikagrout 212 by Sika

.3 Flexocrete by Dural

.2 Dry Pack Grout:

.1 Sikatop 212 by Sika

.3 Bonding Agent:

.1 Sikadur 32 Hi-Mod by Sika

.2 Sika Top Armatec 110

.4 Full or Partial Depth Horizontal Repairs

.1 Cast-in-Place Portland Cement Concrete

.2 High Performance Concrete

.3 Sikatop 122 Plus by Sika

.4 Mapecem 202 by MAPEI

.5 Master Emaco T1061 by BASF

.5 Vertical Face

.1 Sikatop 123 Plus by Sika

.2 Sikagrout 212 flowable grout supported by formwork if anchored with reinforcing steel

.3 High Performance Concrete supported by formwork if anchored with reinforcing steel

.4 Planitop 23 by MAPEI

.5 Polyfast FS by Dayton Superior

.6 EucoRepair V100 by Euclid Canada

.6 Overhead Repairs

.1 SikaRepair 223*

.2 Sikatop 123 plus*

*All overhead repair materials shall be installed with an appropriate corresponding bonding agent

.7 Form and Pour or Form and Pump

.1 High Performance Concrete

.2 Sikacrete 08 SCC by Sika

.3 Planitop 15 by MAPEI

.4 Master Emaco S440 MC by BASF

.8 Low Temperature Repairs

.1 Set 45

.2 Patchmate PLUS

.9 Surface applied corrosion inhibitors

.1 Sika FerroGard-903

.10 Crack Repairs

.1 Sikadur 35 Hi-Mod LV

.2 Sikadur 52

.3 Sikadur 55 SLV

.4 Sikadur Injection GF

.11 Other products may be used subject to review by Departmental Representative.

## 2.4 EQUIPMENT

.1 Power-driven hand tools for removal of concrete will be permitted for areas shown on the Drawings unless specified otherwise with the following restrictions:

.1 Jack hammers and chipping hammers heavier than normal 15 kg shall not be used to remove concrete.

.2 Once the reinforcing steel is reached, jack hammers or mechanical chipping tools shall not be operated at an angle in excess of 45 degrees measured from the surface of the deck slab.

.3 Mechanical scrabblers of 8 Nm (6 ft/lb) impact, grinders or shotblasting, capable of removing the concrete and producing an angular finished surface.

.4 Concrete cutting saws capable of sawing to the depths indicated on the Drawings (without damage to reinforcing steel).

.5 Hand tools such as hammers and chisels.

.2 As an alternate other equipment may be used for concrete removal upon approval from the Departmental Representative, if it can be demonstrated that the method will not damage overlying and/or underlying or adjacent concrete elements.

.3 Hand tools such as hammers and chisels.

## PART 3. EXECUTION

### 3.1 SURFACE PREPARATION

.1 Clearly mark the extent of concrete removal areas as identified by the Departmental Representative and Contractor during the examination.

.2 Within designated areas, concrete shall be removed to obtain a minimum of 25 mm clearance around visibly corroded or debonded reinforcement or reinforcement with greater than half its cross section exposed.

.3 Minimum depth of concrete removal shall be as specified on the Drawings and in the Specifications or as directed by the Departmental Representative.

.1 Where the Drawings have called for an extent of removal measured from the back facing of reinforcing steel, it is expected that the removal is not complete until the appropriate clearancing of the reinforcing steel has been achieved.

.4 Upon exposure of visibly corroded or debonded reinforcement, additional concrete removal shall be performed until bars appear to be rust free or until otherwise directed by the Departmental Representative.

.5 Outline patch area with a 13 mm deep vertical sawcut as close as possible to limits of concrete already removed. Reduce sawcut depth if necessary to avoid cutting reinforcement. Remove concrete to sawcut taking precautions to avoid damaging sawcut edge. **Edges with spalls or chips will be rejected and shall be re-sawcut at Contractor's expense.**

.6 The Contractor shall exercise due care and precaution in order to prevent uncontrolled removal of concrete. Any removals beyond the indicated areas shown on the Drawings or as approved by the Departmental Representative, shall be reinstated at the Contractor's expense.

.7 Care shall be taken to prevent damage to existing steel reinforcing.

.8 Remove all defective concrete, laitance, dirt, oil, grease and other foreign materials from concrete surfaces by hammer chipping, as required, until a sound, clean, roughened concrete surface is achieved.

.9 Remove all rust from reinforcing by sandblasting.

.10 Prepare surfaces to be repaired in conformance with product manufacturer's recommendations and this Specification.

.11 Roughen surface to ICRI Standard CSP7 to ensure proper bond.

.12 Prior to erection of formwork again all surfaces shall be washed with high pressure washer.

.13 The temperature of the material to which the grout is to be placed shall be between 5 - 25ºC. Use heating or cooling procedures as required to stay within this temperature range. Maintain this temperature range for a minimum period of 24 hours prior to, during and 72 hours after application.

### 3.2 FORMWORK

.1 Forms shall be water tight and caulked, if necessary to prevent seepage.

.2 Construct formwork accurately, ensuring grout conforms to lines, levels and dimensions indicated on drawings.

.3 Arrange and assemble formwork to permit easy dismantling and stripping, ensuring grout is not damaged during its removal.

.4 Provide sufficient clearance for proper placement between formwork and area being repaired.

.5 Cover form surfaces with an acceptable release coating.

## 3.3 INSPECTION

.1 Departmental Representative approval of surface cleaning and preparation is required prior to proceeding with concrete/grout placement or closing of forms, if applicable. Notify the Departmental Representative prior to placing repair material to conduct the inspection. Implement all requirements resulting from the inspection prior to proceeding to the installation of repair material.

.2 Provide samples of product to the Departmental Representative on request for testing and inspection.

## 3.4 MIXING OF FLOWABLE GROUT

.1 Mix the grout in accordance with the manufacturer's instructions and this Specification.

.2 Adequate mixing capacity shall be on-site to ensure rapid, continuous and uninterrupted placement. A standby mixer is recommended.

.3 Mix close to the pour location and limit transportation and placement time to 10 minutes. Transport the grout as to prevent segregation.

.4 Do not mix more grout than can be placed in 10 minutes.

.5 Mixed grout temperature shall be between 5 - 25ºC using ice or warm water (not to exceed 30ºC) to maintain the proper mixed temperature.

.6 No re-tempering shall be permitted once the grout is mixed.

.7 Mix the grout until it is homogeneous in colour.

.8 Upon completion of all formwork and just prior to placing repair material, pre-wet patch surfaces. It is intended that the prepared surfaces be in a saturated surface dry condition before the concrete is placed.

.9 Apply an approved bonding agent, in accordance with the manufacturer's recommendations, prior to grouting, to all areas being patched as well as any exposed reinforcing steel.

## 3.5 PLACING FLOWABLE GROUT

.1 Place flowable grout in areas designated by the Departmental Representative.

.2 Grout shall be placed from one side only allowing the grout to push air ahead and out as the space if filled. Placing should be rapid and continuous.

.3 Do not vibrate grout.

.4 Grout deep depressions first.

.5 Abide by the requirements of CSA CAN3-A23.1 regarding cold weather conditions and this specification.

## 3.6 PROTECTION AND CURING

.1 Keep the grout from freezing for at least 7 days.

.2 Do not remove forms until after final set.

.3 Allow Departmental Representative to inspect concrete surface immediately after removal of forms.

.4 Any imperfections shall be patched at once before the grout is thoroughly dry. Imperfections are to be in accordance with this specification herein or indicated on Drawings to the approval of the Departmental Representative.

.5 Immediately following removal of forms, all fins and irregular projections shall be moved from all surfaces.

.6 After stripping the forms cure all exposed grout surfaces in conformance with the manufacturer's recommendations.

## 3.7 MIXING DRY PACK GROUT

.1 Mix grout in accordance with manufacturer's recommendations and this specification.

.2 Adequate mixing capacity shall be on-site to ensure rapid, continuous and uninterrupted placement. A standby mixer is recommended.

.3 Mix close to the pour location and limit transportation and placement time to 10 minutes. Transport the grout in an effort to prevent segregation.

.4 Do not mix more grout than can be placed in 10 minutes.

.5 Mixed grout temperature shall be between 5 - 25ºC using ice or warm water (not to exceed 30ºC) to maintain mixed temperature.

## 3.8 PLACING DRY PACK GROUT

.1 Place dry pack grout where designated by the Departmental Representative in conformance with manufacturer's recommendations and this specification.

.2 Apply an approved bonding agent, in accordance with manufacturer's recommendations prior to grouting, to all areas to be patched as well as all exposed reinforcing steel.

.3 Place grout in conformance with manufacturer's recommendations and this specification.

.4 Trowel finish the surface of the path to the correct profile.

.5 Repair any imperfections with this specification.

.6 Cure the patched area in conformance with manufacturer's recommendations.

## 3.9 FIELD QUALITY CONTROL

.1 Testing of patching materials shall be conducted by an independent testing agency paid for by the Contractor.

.2 All re-testing, if required, shall be at the Contractor's expense.

.3 The Contractor shall contact the testing agency with sufficient notice to be present at the time of pouring.

.4 The Contractor is to provide access for all testing and inspections.

.5 The Contractor shall provide patching materials from field batches for the casting of test cubes, as required.

.6 Materials not meeting these specifications shall be replaced at the Contractor's expense.

.7 Where used, grout shall be tested a minimum of once per day or maximum 0.25 $m^3$ of grout, whichever is more frequent.

### 3.10 DISPOSAL

.1 Dispose of concrete and other debris from the site.

## PART 4. MEASUREMENT AND PAYMENT

### 4.1 MEASUREMENT

.1 Concrete Repair items specified as lump sum bid items will not be field measured, but will be paid at the lump sum price bid and no separate payment will be made. The lump sum prices for these items will be full compensation for all engineering, labour, materials and equipment necessary to complete the work, including all subsidiary and incidental items thereto for which separate payment is not elsewhere provided.

.2 Preparation of the concrete substrate, profile patching of concrete, removal of paint and disposal of debris will not be measured.

.3 Crack preparation will be field measured in linear metres. The length will be determined by measuring the length in the field. The extent of preparation shall be agreed by the Contractor and Departmental Representative prior to starting the work.

### 4.2 PAYMENT

.1 Payment shall include compensation for unsound concrete removal, surface preparation, sandblasting, installation of repair material, curing, finishing and all incidental cost of labour and materials necessary to complete the work in accordance with the Drawings and Specifications.

.2 Payment shall be inclusive of all labour, equipment, materials, small tools, maintenance, incidentals, insurances, overhead and fee, environmental, public and utility protection, concrete chipping, hoarding, water testing and treatment, water control, drainage, temporary piping, coordination with agencies and utilities, material handling and disposal and cleanup as necessary to provide a complete job.

.3 Payment will not be made for work, which extends beyond the limits required in the Contract Documents or not authorized by the Departmental Representative.

.4 Repairs performed to a depth greater than depths specified on the drawings, if not authorized by the Departmental Representative, shall be paid as repairs to the depths specified on the drawings.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESIGN REQUIREMENTS

.1 Sign supports and appurtenances shall be capable of withstanding summation of the following loads:

.1 Wind and ice loading specified to be consistent with anticipated loads in locality of installation. Refer to National Building Code of Canada and/or applicable provincial building code.

.2 Dead load of signboards, sign supports and appurtenances.

.3 Ice load on one face of signboards and around surface of all structural members and appurtenances.

.2 Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO) "Specifications for the Design and Construction of Structural Supports for Highway Signs".

### 1.2 SHOP DRAWINGS

.1 Submit shop drawings for signage structures indicating product data and design.

## PART 2. PRODUCTS

### 2.1 SIGN SUPPORTS

.1 Timber Posts shall be:

.1 Species: Spruce.

.2 Type: Pressure treated rough cut or S4S.

.3 Grade: No. 2 or better.

.4 Dimensions: 100 x 150 mm, heights to fit sign locations as indicated.

.5 CAN/CSA-Z809 or FSC or SFI certified.

.2 Aluminum Posts shall be:

.1 Tubular aluminum posts with 89 mm diameter (outside diameter) and wall thickness of 5.4 mm complete with base plates and mounting hardware.

.2 The tubular steel posts shall have a top cap that prevents material from entering the post from the top.

.3 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminium alloy, or galvanized steel.

### 2.2 SIGNBOARDS

.1 Aluminium sheet to ASTM B209M, pre-cut to required dimensions. Minimum thickness to be 1.6 mm for signboards up to 750 mm wide. Minimum thickness to be 2.0 mm for signboards 750-1200 mm wide.

.2 Connecting straps and brackets to ASTM B209M.

.3 3M HI-Intensity Scotchlite.

### 2.3 FABRICATION

.1 Signboards

.1 Aluminium blanks: Degrease, etch and bonderize with chemical conversion coating. Clean surfaces with xylene thinner. Dry. Aluminium signboards are to be painted before installation. Spray and bake face of signboards with two coats of enamel in accordance with CAN/CGSB-1.104.

.2 Sign identification

.1 Apply sign number and date of installation with 25 mm high stencil painted black letters on lower left back face of each signboard.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 Sign Support

.1 Erect supports as indicated. Where separate concrete footings have been placed, erect posts with base plates resting on levelling nuts and restrained with nuts and washers.

.2 Coat underside of base plate with corrosion protective paint before installation.

.3 Close open aluminium tubes and posts with aluminium cap.

.4 Erect posts plumb and square to road.

.5 Single channel steel posts are to be driven to required depth without damage to posts. If rock or concrete is encountered, auger hole to required depth and set post in sand.

.6 In finished concrete or asphalt surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.

.7 Wooden post installations are to be excavated with an auger. Compact bottom of hole to provide firm foundation. Set post and backfill in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.

.8 Permissible tolerance is ±12 mm departure from vertical over post hieght.

.2 Signboard

.1 Fasten signboards to supporting posts and brackets as indicated.

.2 Use strapping with crimped or bolted connections where signs fastened to utility poles.

### 3.2 PROTECTION

.1 Place temporary covering on signboards where required. Covering to be capable of withstanding rain, snow and wind and be undamaging to signboard. Replace deteriorated covering and remove covers as reviewed by Departmental Representative.

### 3.3 CORRECTING DEFECTS

.1 Correct defects, such as consistency of reflectivity, colour, illumination or as identified by Departmental Representative.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 REFERENCES

.1 Reference documents listed below form part of this Specification to the extent specified in this Section.

.2 Reference documents

.1 Comply with applicable standards of following organizations:

.1 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.2 National Electrical Manufacturers Association. (NEMA).

.3 Institute of Electrical and Electronic Engineers (IEEE).

.4 Insulated Power Cable Engineers Association (IPCEA).

.5 Canadian Electrical Code (CEC) (CSA 22.1 – latest edition)

.6 Canadian Standards Association (CSA)

.7 Area Electrical Inspection Authority

### 1.2 SUBMITTALS

.1 Provide the following submittals.

.2 Shop Drawings and Product Data

.1 Twenty (20) days prior to fabrication, submit for the approval of the Departmental Representative, the shop drawings, product data and samples as specified, indicating details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment and materials. Include data on manufacturer's recommended environmental conditions for equipment affected by temperature and humidity.

.2 Provide vendor shop drawings including but not limited to wiring, single line and schematic diagrams where applicable. Wiring drawings or diagrams shall show interconnection among work of different Sections.

.3 Cross or block out from manufacturer's standard product data sheets all data inapplicable or irrelevant to project.

.3 Certificates

.1 Within 7 days of inspection, submit inspection certificates of any authority having jurisdiction of any part of the Work.

.4 Project Record Documents

.1 Comply with requirements of Section 01 78 00 – Closeout Submittals.

.2 Record accurately all changes that are made during construction.

.5 Reports

.1 Collect and submit field reports including the following:

.1 Start-up and testing reports.

.2 Manufacturer start-up and testing reports.

.6 Electrical Permit

.1 Copy of electrical permit obtained from authority having jurisdiction.

## 1.3 QUALITY ASSURANCE

.1 Regulatory Requirements

.1 Comply with Safety Codes Act and rules and regulations made pursuant thereto, including Canadian Electrical Code.

.2 Unless otherwise indicated, all references in the Contract Documents to "Canadian Electrical Code" or "CEC" refers to the edition of the Canadian Electrical Code, Part I, CSA C22.1 - latest edition and the variations made thereto by Alberta regulation, which are in force on the date of bid closing for the Contract.

.3 Should any instance occur in this Specification or on the Drawings in which the materials or construction methods called for are less than the minimum requirements of the above codes, the requirements of the codes to take precedence, and the Contractor is to supply the materials and perform the work as though called for to the minimum code standards.

.4 All electrical products to be tested, certified and labelled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labelled, provide written approval by the authority having jurisdiction.

.5 Aforementioned minimum standards are not to detract from the quality of materials or methods of installation shown where these exceed said standards.

.6 Submit to authority having jurisdiction and utility company, necessary number of drawings and specifications for examination and approval prior to commencement of electrical work. Pay associated fees.

.7 Notify the Departmental Representative of changes required by Electrical Inspection Authority prior to making changes. Make reasonable changes and alterations required by the Inspection Authority at no extra cost to Parks Canada Agency.

## 1.4 INTENT

.1 The Contractor shall furnish all labour, materials and necessary equipment to provide complete and operating electrical systems as set forth on the plans and in these Specifications, and as called for elsewhere in the Contract documents. Any work, even if not shown or specified, which is obviously necessary or reasonably implied to complete the work, shall be carried out as if it was both shown and specified.

.2 Short Circuit and Arc-Flash Study

.1 Prepare and submit a short circuit study of all electrical system components including but not limited to: Utility Service transformers, CDP's, and sub-panelboards.

.2 Arc Flash study must be stamped and signed by a Registered Professional Engineer, licensed to practice in the Province of Alberta.

.3 The study shall include arc flash hazard analysis in accordance with CSA Z462 for the entire power distribution system. Flash hazard results shall be clearly marked in schematic and tabular form at each connection point on the distribution system in accordance with the referenced standard. The arc flash

protection boundary shall be calculated at significant locations in the electrical distribution system where work could be performed on energized parts.

.4 Any additional data necessary for successful completion of the short circuit and arc flash study shall also be included.

.5 Symmetrical and asymmetrical fault current calculations shall be submitted to verify the correct choice of the protective elements of the system. Include a list of recommended settings for each relay.

.6 A preliminary study shall be completed by or with coordination with the electrical distribution manufacturer prior to approval of shop drawings for general interrupting capacity (IC) ratings of all major pieces of equipment. This study shall be submitted along with the shop drawings for review.

.7 The final study shall be based on, and make reference to, actual installation and As-built mark ups drawings and data provided by the Electrical Contractor.

.8 Electrical contractor to provide all required data to supplier to facilitate completion of the study.

.9 Submit the results of short circuit study in maintenance manuals.

.10 Provide and install Arc Flash labels on equipment; labels to include the following information:

.1 System voltage

.2 Flash protection boundary

.3 Personal Protective Equipment (PPE) category.

.4 Arc Flash incident energy value (cal/m2)

.5 Limited, restricted and prohibited Approach Boundaries

.6 Study report number and issue date

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 All equipment and material to be new and CSA certified and conform to EEMAC Standards. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Authority and the Departmental Representative.

.2 Where two or more items of the same kind are required, all such items to be the product of a single manufacturer.

## PART 3. EXECUTION

### 3.1 EXECUTING THE WORK

.1 Promptly install work in advance of concrete pouring or similar work. Provide sleeves and any materials to be embedded in concrete and locate them where required.

.2 Complete all cutting required for electrical installation. Do not cut structural members without the written consent of the Departmental Representative.

.3 Patch and repair surfaces damaged by cutting for electrical work.

.4 Guard exposed live electrical equipment during construction for personnel safety, and provide applicable warning signs.

## 3.2 EQUIPMENT IDENTIFICATION

.1 Equipment Identification

.1 Provide engraved nameplate identification on panelboards, motor control and protection equipment, and junction boxes.

.2 Panelboard Directories: Identify loads controlled by each overcurrent protective device in each panelboard, by means of a lamacoid weather rated panelboard directory.

.3 Nameplates: lamacoid 3 mm thick plastic engraving sheet, black face, white core, mechanically secured to the equipment with self-tapping screws.

.4 Nameplate sizes:

| | | | |
|---|---|---|---|
| Size 2 | 12 x 70 mm | 1 line | 5 mm high letters |
| Size 3 | 12 x 70 mm | 2 lines | 3 mm high letters |
| Size 4 | 20 x 90 mm | 1 line | 8 mm high letters |
| Size 5 | 20 x 90 mm | 2 lines | 5 mm high letters |

.5 Nameplate sizes and wording on nameplates to be approved prior to manufacture.

.6 Allow for average of 25 letters per nameplate.

.7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.8 Submit wording of the nameplates to Departmental Representative for approval before ordering.

.2 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring, and on both ends of all control wires. Use hot stamped heat shrinkable sleeves for numbered tags.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1. Refer also to Section 26 05 21 - Wires and Cables.

## 3.3 WIRING TERMINATIONS

.1 Supply lugs, terminals and screws used for termination of wiring suitable for either copper or aluminium conductors.

## 3.4 MANUFACTURER'S AND CSA LABELS

.1 Ensure that manufacturer's nameplates and CSA labels are visible and legible after equipment is installed.

## 3.5 WARNING SIGNS

.1 Provide warning signs, as specified or to meet requirements of Inspection Authorities and Departmental Representative.

.2 Use porcelain enamel signs, minimum 175 x 250 mm size.

## 3.6 FORTISALBERTA CASH ALLOWANCE

.1 The Contract shall include a Cash Allowance for FortisAlberta agreements related to the project. The Cash Allowance is to provide a completed FortisAlberta system inclusive of FortisAlberta service agreements and design of services related to the FortisAlberta design installation. This includes FortisAlberta removals, and installation of the new FortisAlberta services completed by FortisAlberta.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

### 1.2 REFERENCES

.1 Provide wires and cables in accordance with the following standards (latest revision) expect where specified otherwise.

.2 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 75-M, Thermoplastic Insulated Wires and Cables.

.2 CSA C22.2 No. 51, Armoured Cables.

.3 CSA C22.2 No. 131, Type TECK 90 Cables.

.4 CSA C22.2 No. 48, Non-metallic Sheathed Cables.

.5 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

### 1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Provide Materials in accordance with the following.

.2 Wiring

.1 Wiring to CSA C22.2 No. 75-M, and as follows:

.1 Power Conductors: stranded copper for No. 12 AWG and larger. Minimum size: 12 AWG.

.2 Control Conductors: stranded copper, minimum No. 14 AWG.

.3 Insulation: RW90 X-link -40oC.

.4 Insulation Rating: 600 V.

.5 Sizes: as indicated on drawings or as required by code.

.3 Cables

.1 ACWU Armoured cable to CSA C22.2 No. 51, and as follows:

.1 Conductor: Aluminum.

.2 Insulation: RW90 X-link.

.3 Rating: 600V.

.4 Size: as indicated on drawings, and where not mentioned shall be as required by CEC at minimum.

.5 Configuration: as indicated on drawings.

.6 Armour: aluminium interlocking.

.7 Low flame spread PVC jacket with FT4 and AG14 rating.

.2 Type TECK 90 cable to CSA C22.2 No. 131, and as follows:

.1 Conductor: copper.

.2 Insulation: cross linked polyethylene (XLPE).

.3 Rating: 600 V, Class 1, Division 2 approved.

.4 Size: as indicated on drawings or as required.

.5 Configuration: as indicated on drawings.

.6 Inner Jacket: PVC -40$^{o}$C.

.7 Armour: interlocking aluminium.

.8 Outer Jacket: PVC -40$^{o}$C.

.3 Fastenings

.1 One hole steel straps to secure surface cables 53 mm and smaller. Two hole steel straps for cables larger than 53 mm.

.4 Connectors

.1 Provide factory fabricated, metal connectors of sizes, amperage ratings, materials, types and classes for applications and for services indicated.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 General

.1 Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.

.2 Splice only in junction or outlet boxes.

.3 Provide identical conductor length for parallel circuits.

.4 Neatly train and lace conductors inside cabinets, equipment and panelboards.

.5 At each end of the run, leave sufficient cable for termination and maintenance.

.2 Wire Connections and Terminations

.1 Use solderless pressure connectors with insulated covers for copper wire splices and taps, No. 8 AWG and smaller.

.2 Use insulated spring wire connectors with plastic caps for conductors No. 10 AWG and smaller.

.3 Use split bolt connectors for copper wire splices and taps, No. 6 AWG and larger. Tape un-insulated conductors and connectors with electrical tape to 150% of insulation value of conductor.

.3 Teck 90 Cable

.1 Provide protection for exposed cables where subject to damage.

.2 Install cable in trenches in accordance with this Section.

.3 Support horizontal runs on cable tray or channels complete with spacers and clamps.

.4 Group cables wherever possible on channels.

.5 Support vertical runs on channels complete with spacers and clamps.

.6 Support cables minimum one diameter apart. Maintain equal spacing across supports.

.4 Wire Size

.1 Lighting Circuits: No. 12 AWG minimum.

.2 Power Circuits: No 12 AWG minimum, except as follows:

.1 No. 10 AWG for 15 A, 120 V circuits longer than 23 m.

.2 No. 8 AWG for 15A, 120 V circuits longer than 39 m.

.3 Motor Circuits: No. 12 AWG minimum, except as otherwise indicated on Drawings.

.4 Feeder Circuits: as indicated on Drawings.

.1 Where panel feeder conductor sizes are not indicated on Drawings, cable to be sized and installed to meet CEC requirements.

.5 Direct Burial of Cables

.1 Do not put any electrical cable in the same trench that is provided for pipe lines.

.2 Maintain minimum of 800 mm distance from any pipe line where electrical service is crossing the pipeline.

.3 Lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.4 Trench the service cable as indicated on drawings. Provide a cable marker.

.5 Provide offsets for the thermal action and minor earth movements. Offset cables 150 mm for each 60m run, maintaining minimum cable separation and bending radius requirements.

.6 Underground cable splices are not acceptable.

.7 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

### 1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

## PART 2. PRODUCTS

### 2.1 EQUIPMENT

.1 Grounding and bonding equipment to CSA C22.2 No. 41.

.2 Rod electrodes: copper clad steel, 20 mm diameter by 3 m long.

.3 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.4 Insulated grounding conductors: green, type TW, continuous lengths.

.5 Isolated ground conductors: Stranded copper with green insulation, to control panel isolated ground bar and lighting arresters. Refer to Drawings for wire size.

.6 Ground bus: copper, complete with insulated supports, fastenings, connectors.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

## PART 3. EXECUTION

### 3.1 INSTALLATION GENERAL

.1 Comply with requirements of CSA C22.2 No. 0.4-M and Canadian Electrical Code.

.2 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to conductive water main, electrodes, permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Connect building structural steel and metal siding to ground.

.10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.11 Provide an isolated ground conductor from the ground grid to the system neutral point for the grounding of building electrical services. This must be separate from the building structure ground conductor. DO NOT use the building structure ground to ground electrical equipment.

.12 Unless otherwise indicated, continuously ground neutral and metallic noncurrent carrying portions of all electrical equipment and electrically operated equipment.

.13 To maintain ground continuity throughout electrical system, install separate ground conductors in all non-metallic raceways and all metallic raceways situated in concrete and/or below finished grade. Separate ground conductors shall be installed in all raceways subject to corrosion or deterioration.

.14 Ground wiring devices by a separate conductor to ground lug of outlet boxes.

.15 Install separate ground conductor to outdoor lighting standards.

## 3.2 ELECTRODES

.1 Install rod electrodes and make grounding connections. Use size 3/0 AWG copper conductors for connections to electrodes unless noted otherwise.

.2 Bond separate, multiple electrodes together.

## 3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of all transformers.

## 3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

## 3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall.

## 3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

## PART 2. PRODUCTS

### 2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

.2 Straps: steel.

.3 Inserts: plastic expansion types.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

.2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.3 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.4 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.5 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Departmental Representative.

.6 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

## PART 2. PRODUCTS

### 2.1 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers Surface Mounted: screw-on turned edge covers.

.3 Use only NEMA 4X rated junction boxes

### 2.2 CABINETS

.1 Refer to drawings for accepted CDP equipment and concreter bases.

.2 Concrete bases shall be of reinforcement that meets CSA A23.3.04, clause 7.8 Minimum Reinforcement in Slabs at minimum.

.3 All cabinets shall be of the same key.

.4 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.5 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface mounting.

### 2.3 BUSHINGS, KNOCKOUT CLOSURES, AND LOCKNUTS

.1 Bushings, Knockout Closures and Locknuts: to CSA C22.2 No. 18, corrosion resistant.

## PART 3. EXECUTION

### 3.1 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 grade.

.3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 Except where otherwise indicated, install boxes for vertical mounting of devices.

.5 Support boxes independent from conduit.

.6 Use metal outlet boxes, except in damp or wet locations where non-metallic outlet boxes are to be used.

.7 Junction boxes shall be at minimum use; all terminations shall be inside the power distribution equipment.

.8 Avoid installing pull boxes in traffic paths; if conditions mandate doing so, consult with the Departmental Representative for approval.

## 3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

.3 Submit, for Parks Canada Agency approval, a list of the wording of the identification before ordering.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.2 CSA C22.2 No. 45-M1981 (R2003), Rigid Metal Conduit.

.3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

## PART 2. PRODUCTS

### 1.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel or aluminum threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.4 DB-2 PVC conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.

### 2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. 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 run parallel.

.4 Threaded rods, 6 mm dia., to support suspended channels.

### 2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

### 2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

**2.5 PULL WIRE**

.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 Surface mount conduits in all areas, except underground feeds.

.3 Use rigid galvanized steel or aluminum threaded conduit except where specified otherwise.

.4 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.

.5 Use DB-2 PVC conduit underground.

.6 Minimum conduit size for lighting and power circuits: 21 mm.

.7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.8 Mechanically bend steel conduit over 19 mm dia.

.9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.10 Install pull cord in empty conduits.

.11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.12 Dry conduits out before installing wire.

**3.2 SURFACE CONDUITS**

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum clearance of 25 mm at crossovers.

**3.3 CONDUITS UNDERGROUND**

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.4 Section 31 23 10 - Excavating, Trenching and Backfilling.

### 1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

## PART 2. PRODUCTS

### 2.1 PVC DUCTS AND FITTINGS

.1 Rigid PVC duct: to CSA C22.2 No. 211.1, Type DB2/ES2, with moulded fittings, for direct burial, Trade size as indicated. Nominal length: 6 or 3 m plus or minus 12 mm.

.2 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.

.3 Rigid PVC 90° and 45° bends.

.4 Rigid PVC 5° angle couplings.

### 2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC duct joints.

### 2.3 CABLE PULLING EQUIPMENT

.1 0.6 mm stranded nylon pull rope tensile strength 5 kN.

### 2.4 MARKERS

.1 Continuous traceable CSA approved marker tape warning of buried power or telephone cables.

### 2.5 PULL BOXES

.1 Approved for underground direct burial, PVC, watertight.

## PART 3. EXECUTION

### 3.1 DIRECT BURIAL OF CABLES

.1 Maintain minimum of 800 mm distance from any pipe line where electrical service is crossing the pipeline.

.2 Sand bedding shall be as per drawings.

.3 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.

.4 Trench the service cable as per drawings. Provide cable marker tape.

.5 Make termination and splice only as indicated leaving 0.6 m of surplus cable in each direction.

.1 Make splices and terminations in accordance with manufacturer's instructions using approved splicing kits.

.2 Underground cable splices not acceptable.

.3 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer’s instructions.

.4 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 alarm and control cables when crossing other cables, with alarm and control cables in upper position.

.6 Install treated planks on lower cables 0.6 m in each direction at crossings.

## 3.2 INSTALLATION OF DUCTS

.1 Install duct in accordance with manufacturer's instructions at depth as indicated on drawings.

.2 Clean inside of ducts before laying.

.3 Ensure full and even support every 1.5 m throughout duct lengths.

.4 Slope ducts with 1 to 400 minimum slope.

.5 During construction, cap ends of ducts to prevent entrance of foreign materials.

.6 Pull through each duct a wooden mandrel not less than 300 mm long and of a diameter 6 mm less than internal diameter of duct, followed by a stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.7 In each duct install polypropylene pull cord continuous throughout each duct run with 3 m spare rope at each end.

.8 Install markers at depth as indicated on drawings for entire length of run.

.9 After 150mm thick of sand bedding is in place, lay ducts maintaining 75 mm clearance from each side of trench to nearest duct, then cover with an additional 150 mm of sand fill.

.10 Install pull boxes in accordance with CEC requirements.

.11 Keep number of splice boxes to a minimum.

.12 Provide concrete markers above all pull and splice boxes.

## 3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in 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 After installation of cables, seal duct ends with duct sealing compound.

## 3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for 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 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.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.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Service equipment and installation.

### 1.2 RELATED SECTIONS

.1 Section 26 05 28 - Grounding - Secondary.

.2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.3 Section 26 28 16.02 - Moulded Case Circuit Breakers.

.4 Section 26 24 16.01 - Panelboards Breaker Type.

## PART 2. PRODUCTS

### 2.1 EQUIPMENT

.1 Enclosed circuit breaker: in accordance with Section 26 28 16.02 - Moulded Case Circuit Breakers, rating as indicated on drawings.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 Install service equipment.

.2 Connect to incoming service.

.3 Connect to outgoing load circuits.

.4 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.5 Make provision for power supply authority's metering.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

### 1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 01 - Common Work Results for Electrical.

.3 Section 26 28 16.02 - Moulded Case Circuit Breakers.

### 1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.29-M1989(R2000), Panelboards and Enclosed Panelboards.

### 1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

## PART 2. PRODUCTS

### 2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 120/240 V panelboards: single phase, 3 wire, solid neutral design, bus and breakers rated for 65 kA (symmetrical) interrupting capacity or as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Spaces: stamp out spaces, install removable fillers where breaker spaces are shown.

.6 Spares: provide spare breakers where indicated on the panel schedule.

.7 Two keys for each panelboard and key panelboards alike.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Mains: suitable for bolt-on breakers.

.10 Trim with concealed front bolts and hinges.

.11 Trim and door finish: baked grey enamel.

## 2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Two pole breakers to have common simultaneous trip.

.4 Half sized or twin breakers and/or plug in breakers will not be accepted.

## 2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Complete circuit directory with typewritten legend showing location and load of each circuit.

.4 Provide directory frame-type holders (separately plastic shielded) on door interiors for typed directories.

# PART 3. EXECUTION

## 3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus.

.5 Provide all mounting brackets, busbar drillings and filler pieces for spaces.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

### 1.2 REFERENCES

.1 The Munsell System of Colour Notation.

### 1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish, Munsell Notation 7.5GY3.5/1.5, size as indicated on drawings.

.2 Entire enclosure capable of withstanding maximum impact force of 86 MN/m² area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Enclosure equipped with hot dipped galvanized mounting rails 1 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.

.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: minimum 1 m wide, hinged, 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

.8 Enclosure construction such as to allow any configuration of single or ganged enclosures.

.9 Enclosure capable of being shipped in knocked-down condition.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and mount as indicated.

.2 Mount equipment in enclosure.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

### 1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

### 1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.111-00, General-Use Snap Switches.

### 1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

## PART 2. PRODUCTS

### 1.5 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-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 alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 White toggle.

.3 Switches of one manufacturer throughout project.

### 1.6 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 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 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

**1.7 COVER PLATES**

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof cover plates that maintain weatherproof rating when in operation.

**1.8 PHOTOCELL**

.1 Line voltage control sensor

.2 Respond to the light spectrum near to thatof a human eye.

.3 Operation: delay up to two minutes to prevent false switching due to light from passing vehicles, lightning, etc.

.4 Standards: CSA or equivalent approved meets ANSI /UL773A.

**PART 3. EXECUTION**

**1.9 INSTALLATION**

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results for Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Photocell:

.1 Factory installed by manufacturer.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers, and ground-fault circuit-interrupters.

### 1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 24 16.01 - Panelboards - Breaker Type.

### 1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures.

### 1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include time-current characteristic curves for breakers with ampacity of 100 A or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

## PART 2. PRODUCTS

### 2.1 INTERRUPTING RATING

.1 All circuit breakers shall be of minimum interrupting capacity of 65,000 A symmetrical (rms).

### 2.2 BREAKERS GENERAL

.1 Moulded-case circuit breakers and Ground-fault circuit-interrupters: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.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 with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

### 2.3 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.

### 2.4 MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

## 2.5 GROUND FAULT INTERRUPTER BREAKER

.1 Single pole, bolt-on moulded case circuit breaker: 120V, incorporating ground fault interrupter circuit, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient. Integral test button and separate connection to neutral bus.

## 2.6 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker; to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous, tripping for phase and ground fault short circuit protection.

# PART 3. EXECUTION

## 3.1 INSTALLATION

.1 Install circuit breakers as indicated on drawing.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Equipment and installation for ground fault circuit interrupters (GFCI).

### 1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

### 1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.144-M91(R2001), Ground Fault Circuit Interrupters.

### 1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data and shop drawings.

.3 Submit test report for field testing of ground fault equipment to the Departmental Representative and a certificate that system as installed meets criteria specified herein.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144.

.2 Components comprising ground fault protective system to be of same manufacturer.

### 2.2 GROUND FAULT PROTECTOR UNIT

.1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:

.1 Solid state ground sensing device.

.2 Facility for testing and reset.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

### 3.2 QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Demonstrate simulated ground fault tests.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Equipment and installation for secondary lighting arresters.

### 1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

### 1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C233.1-87 (R1999) Gapless Metal Oxide Surge Arresters for Alternating Current Systems.

### 1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

## PART 2. PRODUCTS

### 2.1 EQUIPMENT

.1 Arrester component parts: to CAN/CSA-C233.1.

.2 Arrester characteristics:

.1 System voltage: 240V.

.2 Rated voltage of arrester: 650 V.

.3 Indoor type.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 Install arresters and connect to secondary bus and ground bus.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 SECTION INCLUDES

.1 Materials and installation for steel, aluminum and wood lighting poles.

### 1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

### 1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.206-M1987(R1999), Lighting Poles.

.2 CAN/CSA-O15-90(R1999, Wood Utility Poles and Reinforcing Stubs.

.3 CSA O80 Series-97, Wood Preservation.

### 1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

## PART 2. PRODUCTS

### 2.1 ALUMINUM POLES

.1 Aluminum poles: to CSA C22.2 No.206 designed for underground wiring and:

.1 Mounting on concrete anchor base.

.2 Style: Round extruded 6061-T6 aluminum tubing, wall thickness 8.1 mm, welded to both the bottom and top of the anchor plate.

.3 Access handhole centred 508 mm above pole base for wiring connections, complete with a weatherproof aluminum cover and a copper ground lug.

.4 Size: 102 mm round x 4.27 m.

.5 Anchor bolts: 19 mm x 432 mm steel with shims, nuts, washers and covers.

.6 Finish: Black. Application of polyester powder coat paint (4 mils/100 microns) with ± 1mils/24 microns of tolerance.

.7 Lumec APR4W-14-LBC4C-GN8TX or approved equivalent.

### 2.2 LUMINAIRES

.1 Luminaire with cast aluminum weatherproof housing, dark sky friendly and:

.1 Lamp type: LED, wattage: 35, Lumens: 3318.

.2 Light Distribution:

.3 IES distribution Type II.

.4 Lumec MPTRRC-35W32LED4K-T-LE2-UNIV-PH8-GN8TX or approved equivalent.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 Install poles true and plumb, in accordance with manufacturer's instructions.

.2 Install luminaires on pole top and install lamps.

.3 Check luminaire orientation, level and tilt.

.4 Connect luminaire to lighting circuit.

.5 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DEFINITIONS

.1 Topsoil: The top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding or “A” horizon.

.2 “Subsoil” means the portion of soil material that lies immediately beneath the Topsoil extending to root depth or “B” horizon. The upper portion of the parent material as defined by the Canadian System of Soil Classification.

.3 “Unsuitable Organic Soils” means soils that contain organic materials and are not suitable for use as earthwork materials or as Topsoil and Subsoil. These soils would include soils that contain organic matter and not suitable for earthwork materials, are contaminated, or do not meet the requirements.

## PART 2. PRODUCTS

.1 The Contractor shall supply all labour, materials and equipment required for topsoil stripping.

## PART 3. EXECUTION

.1 The Contractor shall excavate the minimum practical area of topsoil required to perform the Work, or as required by the Departmental Representative.

.2 Topsoil shall be stripped to a depth that will ensure complete removal of all organic materials.

.3 Care must be taken to avoid mixing topsoil with the underlying soil. The Departmental Representative may require that the Contractor provide a separate stockpile for topsoil contaminated with common material.

.4 Strip topsoil from the areas where excavation and fill placement are required.

.5 Where excavation is required, separately strip all topsoil and then subsoil, if necessary, to the required depths and prevent admixing.

.6 Where fill is required, strip topsoil only.

.7 The topsoil shall be stockpiled in areas designated by the Departmental Representative in the field. Alternatively, topsoil can be stockpiled and mixed at Upper Compound if approved by the Departmental Representative.

.8 Sequence, stagger, and conduct stripping and excavation operations so that undesirable mineral soil does not become mixed with topsoil or subsoil.

.9 Sod that is stripped with topsoil shall be broken into 50mm or smaller pieces and mixed with the topsoil.

.10 Suspend stripping operations during rain, snow, wet ground conditions, high winds, or other conditions that may result in contamination or loss of material.

.11 Drain surface water away from the stripped areas to prevent ponding and infiltration in fill placement areas.

.12 Stockpile topsoil at locations specified in the Contract Documents or as approved by the Departmental Representative

.13 Maintain a minimum separation of 3 m between stockpiles of differing materials.

.14 Use silt fences and other erosion control measures to prevent soil loss from the stockpiles due to wind or water erosion.

.15 Do not interfere with drainage courses with stockpiled material. Keep stockpiles a minimum distance of 30 m from bodies of water or drainage courses.

.16 Do not stockpile material at slopes steeper than 3H:1V. Do not stockpile material higher than 2 m.

.17 Maintain stockpiles in a condition meeting the above requirements

.18 Topsoil stored for longer than two (2) years shall be cleaned of all surface vegetation, shredded, spread, rototilled to a friable consistency before placement on site.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies requirements for excavation, backfill and compaction and other associated work required to construct embankments, foundations and road subgrades to the required cross sections and grades indicated in specifications and shown on drawings or as directed by Departmental Representative.

.2 Site preparation, removals, topsoil stripping and finishing work (roads and landscaping) is not included in this Section.

### 1.2 RELATED WORK

.1 01 35 29 Health and Safety Requirements

.2 01 35 43 Environmental Procedures

.3 01 41 00 Regulatory Requirements

.4 01 43 00 Quality Control

.5 01 56 00 Temporary Barriers and Enclosures

.6 31 14 13 Soil Stripping and Stockpiling

### 1.3 DEFINITIONS

.1 Class I Backfill (a.k.a. Granular Backfill) shall be used for building foundations and where indicated on the drawings. Class I Backfill material shall be a natural pit run or blended sand or gravel aggregate material consisting of sound, clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, with a maximum stone size of 100 mm and meeting specific gradation as described in Part 2 of this specification.

.2 Class II Backfill (a.k.a. Common Backfill) is defined as the excavation of all material other than rock, and shall include over-burden over rock, hard pan, quicksand, frozen earth and boulders up to a size of 0.2 $m^3$ or boulders having an average diameter less than 300 mm.

.3 Imported fill is defined as borrow material from a location to be secured by the Contractor. This fill shall contain no organic material and shall be sand, gravel or clay materials suitable for roadway construction and as approved by the Departmental Representative.

.4 Rock Excavation is divided into two categories; Type A and Type B.

.1 Type A Rock: refers to materials, such as fractured sandstone, shale or ledge rock, which is rippable by a D8 bulldozer or equivalent powered excavator. For open excavation, it refers to materials which, in the opinion of the Departmental Representative, result in:

.1 Substantial delay or decrease in the normal rate of excavation using conventional equipment.

.2 Significant damage or wear to the excavating equipment.

.2 Type B Rock: requires drilling, blasting, wedging or jack hammering to remove, as determined by the Departmental Representative, and cannot be ripped into individual detached masses smaller than 1.5 $m^3$ in size with a single tooth ripper mounted on a D8 bulldozer or equivalent powered excavator as outlined

in the Alberta Roadbuilders and Heavy Construction Association Equipment Rental Rates Guide.

.5 Waste Excavation is the work involved in excavation, disposing and levelling in designated locations those materials determined to be unsuitable or unstable by the Departmental Representative and cannot be removed by conventional earthmoving equipment.

.6 Earthwork is excavating, backfilling, cutting, filling, compacting, grading, shaping and related work.

.7 Swale is defined as broad V-shaped earthen drainage channel of shallow depth with 8:1 or flatter side slopes.

## 1.4 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

.1 The location and elevation of existing underground utilities is compiled from records, if available, but is not guaranteed. Notwithstanding any other provision, the Contractor shall be responsible for determining at his expense the actual location and elevation of all sewer, water and gas mains or lines, electric light, power, telephone or telecommunications, conduits, or other such structures or utilities whether or not shown on the plans. The Contractor shall be responsible for notifying the respective utility at least forty-eight (48) hours in advance of his intention to carry out operations in the vicinity of the said utility and, if required, shall pay for any service supplied for locating of these utilities.

.2 No extra payment will be provided for crossing existing utilities or for special supports for pipelines, cables or poles, or any hand excavation that may be necessary.

.3 If it is necessary to relocate utilities, including poles, because of crossing conflicts with the proposed work, then Parks Canada Agency will be responsible for the payment of the utility relocation. Coordination of the relocation shall be conducted by the Contractor at no cost to Parks Canada Agency.

.4 If it is necessary to relocate utilities, including poles, or structures only to accommodate the Contractor's construction procedure or method, the Contractor shall be responsible for payment of all costs incurred.

.5 Where Work involves breaking into or connecting to existing utilities, carry out work at times directed by the Owner, with minimum of disturbance to users of the services, pedestrian and vehicular traffic.

.6 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active utility service or facility. Adhere to approved schedule and provide notice to affected parties.

.7 Where unknown utilities are encountered, immediately advise Departmental Representative and confirm findings in writing.

.8 Cap or otherwise seal abandoned utilities at cut-off points as shown on the drawings.

.9 Record locations of maintained, re-routed and abandoned utilities indicating horizontal distances and vertical elevations.

.10 Inspect all existing underground and surface structures prior to the commencement of construction, and bring to the attention of the appropriate authority and the Departmental Representative all existing damages. Prior to issuance of the Final Acceptance Certificate, the Contractor shall be responsible for payment for repairs or replacement to correct subsequent damages which may occur.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Excavated material shall be approved by Departmental Representative before use as fill for structural foundations and roadway embankments.

### 2.2 CLASS I BACKFILL MATERIAL:

.1 Class I Backfill material (a.k.a. Granular Backfill) shall be a natural pit run or blended sand or gravel aggregate material consisting of sound, clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, with a maximum stone size of 100 mm and meeting following gradation limits:

| ASTM Sieve Size Designation (mm) | Per Cent Passing (%) |
|---|---|
| 25 | 100 |
| 16 | 40 - 90 |
| 4.75 | 25 - 60 |
| 2.0 | 25 - 60 |
| 0.425 | 10 - 25 |
| 0.075 | 3 - 10 |

.2 Class I Backfill shall be used for building foundations and where indicated on the drawings, installed in maximum 150 mm lifts and compacted to minimum 98% Standard Proctor Maximum Dry Density ASTM D698 (AASHTO T99 Method C).

### 2.3 CLASS II BACKFILL MATERIAL:

.1 Class II Backfill material (a.k.a Common Backfill) shall be select material from excavations, suitable to Departmental Representative for intended use, free of frozen materials, cinders, ashes, sod, organic material, refuse and other objectionable and deleterious substances that would prevent adequate compaction and permit undesirable settlement.

.2 Rocks or stones in excess of 300 mm diameter are not permitted.

.3 Class II Backfill shall be used for roadway and general site grading, constructed in maximum 300 mm lifts and compacted to minimum 98% Standard Proctor Maximum Dry Density ASTM D698 (AASHTO T99 Method C).

### 2.4 CLASS III BACKFILL MATERIAL:

.1 Class III material is not permitted for use in this Contract.

### 2.5 NON-SHRINK/UNSHRINKABLE FILL (FILL-CRETE)

.1 Shall be a controlled low strength material (CLSM) as defined by ACI Committee 229, which states CLSM is a flowable mixture of aggregate and cementitious material containing sufficient Portland cement to develop a 28-day compressive strength of between 0.5 to 2 MPa and self-compacts upon placement.

.2 Non shrink fill shall conform to the following requirements:

.1 28 day Compressive Strength – 0.5 to 2.0 MPa.

.2 Binder – Type 10(GU) Portland Cement – minimum of 30 kg per cubic metre.

.3 Air entrainment – 5% to 8%.

.4 Slump – 175 +/-25 mm (CAN/CSA 3-A23.2-5C).

.5 Aggregate consisting of clean, hard, durable stone or gravel free from lumps, soft or flaky particles, organic matter, salt, alkali and adherent coatings. No more than 10% by weight of the aggregate shall be finer than the 75 mm sieve.

**2.6 PIT LOCATIONS:**

.1 The Contractor shall be responsible for locating, organizing approvals for haul roads, screening or crushing to meet specified gradations, loading, hauling and all other associated work for the specific trenching, backfilling and compaction material requirements.

## PART 3. EXECUTION

**3.1 SITE PREPARATION**

.1 Locate and protect utility lines, survey monuments and benchmarks, instrumentation, fencing, trees and other facilities as required.

.2 Remove and dispose of all snow, surface ice, and excess water prior to starting the excavation.

.3 Remove all existing site furnishings as outlined in the Contract Documents, decommission, demolish and remove any other existing infrastructure and surface materials from areas requiring trenching, earthworks and grading.

**3.2 SUBGRADE PREPARATION**

.1 Prior to placing granular fill in areas requiring structural subgrade support, which includes all driving surfaces, concrete pads and building foundations, areas shall be stripped of all existing deleterious material, scarified and moisture conditioned to a minimum depth of 300 mm, and recompacted to a minimum of 98% of Standard Proctor Maximum Dry Density at a moisture content within 2% of optimum, as determined by ASTM D698, Method 'A'.

.2 Shape entire section, add or remove material as required and compact to grades, elevations and cross-sections shown on drawings. Trim to a tolerance of + 15 mm vertical and 150 mm horizontal.

.3 If fill is required below building foundations, excavate area to competent level ground consisting of suitable subgrade material. Add fill to foundation zone in lifts not exceeding 150 mm and compact as specified.

.4 Key layers of fill into adjacent backslopes overlapping lower lifts to ensure consistent and level layers of material is placed.

**3.3 GRADING**

.1 Earthworks and grading shall include the removal and/or satisfactory placement of all materials necessary for the construction of site embankments, back slopes, drainage works and road subgrades to the alignment, elevation and cross-section shown on the Drawings or as directed by the Departmental Representative.

.2 Grade to elevations and dimensions indicated on Drawings within a tolerance of ±50 mm.

.3 Contractor will be responsible for grading areas adjacent to pavement where required to ensure no water ponding on or adjacent to paved surfaces.

.4 Conditions requisite for the completion of grading work will be roadways and other areas which are smooth and compact over the entire width, firm side slopes with regular

shoulder lines, clean side ditches, satisfactory approaches, intersections and entrances, and smooth back slopes.

.5 All soft and yielding material in the roadway, if so directed by Departmental Representative, shall be removed and replaced with acceptable material, and all loose stones, clods, weeds, trash, etc. shall be removed from the roadway, side slopes, ditches and back slopes. All improperly compacted material shall be excavated, brought to optimum moisture content if required, and recompacted at the Contractor's own expense.

.6 On side slopes and back slopes, and in the bottom of ditches, all projecting boulders must be removed or broken off at least flush with the lines and grades, and the resultant cavities, if any, backfilled.

.7 Sequence, schedule and perform excavation and fill placement operations to make the best use of all excavated material, and to minimize the volume of borrow material required.

## 3.4 EMBANKMENTS

.1 Embankment shall be constructed by depositing, shaping and compacting acceptable excavated materials. The embankments shall be constructed above the natural ground or other level as required by the Departmental Representative, in conformity with the lines, grades and cross-sections shown on the Drawings.

.2 All suitable material from excavations shall be used in forming embankments or shall be otherwise disposed of as the Departmental Representative may require.

.3 Embankment shall be formed of suitable unfrozen material. Stumps, trees, rubbish, sod, topsoil or other unsuitable material shall not be placed in the embankment.

.4 Embankment material shall not be placed on frozen earth, snow or ice, nor shall frozen soils, ice or snow be placed in any embankment. However, on approval of the Departmental Representative, embankment material may be placed on the existing ground surface if frost penetration is 100 mm or less. Any frozen material in the embankment shall be removed and disposed of at the Contractor's expense before proceeding with further embankment construction.

.5 Embankment shall be constructed so that after settlement is complete the required grade and cross-section is attained at all points. If at any time before final acceptance of the work the embankment settles below the required grade, it shall be brought back to the required grade by the Contractor.

## 3.5 EXCAVATIONS

.1 Excavate to lines, elevations and dimensions in accordance with applicable Occupational Health and Safety regulations and the approved Excavation and Shoring Plan. Protect existing structures from damage due to loss of soil support during excavating.

.2 Correct over-excavation below proposed elevations with approved material.

.3 Where soil at proposed elevation of bottom of footings appears unsuitable for foundations, notify the Departmental Representative for remedial action.

.4 Stockpile excavated materials suitable for backfill on site.

.5 Separate materials containing sods, muck, frozen lumps, cinders, ashes, organic or other deleterious substances not suitable for backfill.

.6 Hand trim, make firm and remove loose material and debris from excavations immediately prior to placing cover material or concrete. Where material at bottom of excavation is disturbed, notify the Departmental Representative for an inspection.

.7 Do not commence further work until Departmental Representative has inspected the foundation.

.8 Adequate precautions shall be taken to prevent the material at the foundation level from drying, becoming wet from surface water, or freezing prior to placing cover.

.9 The Contractor is solely responsible for maintaining a safe excavation for all conditions encountered.

.10 Suitable excavated material shall be used as far as practicable in the formation of fills or for other backfill.

**3.6 BACKFILLING**

.1 Do not proceed with backfilling operations until Departmental Representative has inspected and approved Work in place.

.2 Backfill areas excavated and not occupied by parts of substructure or other permanent works, with specified material placed up to surface of surrounding ground.

.3 Prior to backfilling, review the staging of backfilling with the Departmental Representative.

.4 Do not place frozen material in the backfill. During freezing weather conditions, heat the material as necessary to provide enough free moisture to facilitate compaction as specified.

.5 Notwithstanding the above, the Contractor is solely responsible for ensuring the backfill material and equipment used during backfilling operations is carefully selected and staged such that the existing structures or other infrastructure is not damaged or displaced during backfilling operations.

.6 Do not backfill adjacent to any new structure until concrete has cured for a minimum of 7 days and has attained a minimum of 70% of the specified compressive strength.

.7 When using smaller compaction devices, deposit backfill material in lifts not exceeding 300 mm in thickness or less if recommended by the equipment manufacturer, supplier or Departmental Representative.

.8 Where all below grade pipe connections enter a building, additional settlement will occur due to the overlying backfill. Non-shrink fill shall be placed within the pipe embedment zone for a width of outside diameter plus 600 mm bearing on undisturbed soil at the limits of the building excavation.

.9 The pipe embedment in a trench shall be constructed as shown on the drawings and as specified.

.10 The Contractor shall not push backfill directly onto the pipe until there is at least 300 mm carefully placed select bedding material over the pipe to avoid damage to the pipe.

.11 The backfill material shall be pushed down a ramp or slope of existing backfill and not directly onto newly installed items.

.12 Removal of shoring and excavation supports during backfill operation:

.1 Remove shoring, bracing and excavation supports in accordance with the Excavation and Shoring Plan.

.2 Unless otherwise indicated on drawings, remove supports shoring from excavations.

.13 When sheeting is required to remain in place, cut off at elevations required such that the site is unobstructed.

.14 Contractor at his own expense, shall dispose of all unsuitable and surplus material at locations and in a manner satisfactory to Departmental Representative.

## 3.7 COMPACTION

.1 All material placed in embankments shall be spread and bladed smooth in successive layers, not to exceed 300 mm in depth when compacted and to the full width of the cross-section.

.2 Each layer shall be compacted by means approved by the Departmental Representative to a minimum of 98% Standard Proctor Density.

.3 Materials placed in the upper 300 mm of embankments shall not contain rock which has a diameter larger than 300 mm.

.4 The material in each layer shall be compacted at the optimum moisture content ±2%, unless otherwise required by the Departmental Representative. In case of controversy, the degree of compaction and/or moisture content will be determined by in situ density testing before the succeeding layer is placed.

.5 Compaction over the entire surface area of each layer shall be obtained by equipment to meet the specified density requirements. Hauling equipment will not be accepted in lieu of compaction equipment. Compaction to the specified density shall be obtained uniformly throughout each layer.

.6 Where the embankment to be placed traverses yielding ground and it is not possible to place the initial embankment lift in a 150 mm compacted depth, the Contractor may, upon approval of the Departmental Representative, construct the first embankment lift to a depth sufficient to support the construction equipment. All embankment to be constructed above this support will be constructed in 300 mm compacted depths, as herein before specified.

.7 Where moisture content tests indicate that material being used for embankment is above optimum moisture content, the material shall be thoroughly worked until its optimum moisture content is reached.

.8 Where moisture content tests indicate the material for embankment is below optimum moisture, water shall be added. The material shall be thoroughly worked and broken down, water added in amounts as required, and the material thoroughly reworked to mix the water uniformly throughout the soil prior to commencing compaction operations. The type of water hauling and spraying equipment used shall be satisfactory to the Departmental Representative.

## 3.8 OVERHAUL

.1 There shall be no additional payment for overhaul for common excavation and imported fill for embankments. Contractor to determine these costs and include in the unit price bid for excavation and imported fill.

## 3.9 INSPECTION AND TESTING

.1 Quality Control inspection and testing of soil compaction shall be carried out by an independent testing agency hired by and paid for by the Contractor at no extra cost to Parks Canada Agency.

.2 Prior to application of the subsequent layer of backfill, the subgrade surface shall be true to cross-section and grade, shall conform to the density specified and shall show no visible subsidence or heave under the wheels of a roller having a weight of 4.5 kilograms per millimetre of tread width.

.3 Load-testing or proof-rolling shall be conducted by the Contractor, in the presence of Departmental Representative, with as many passes as necessary by slowly driving a fully-loaded tandem truck over the area.

.4 The Departmental Representative and Contractor shall closely observe this operation and note and mark out areas where weakness is indicated. Failures which develop in the subgrade shall be replaced at the Contractor's cost. After the repairs are completed the axle test shall be repeated until test is satisfactory.

.5 All costs incurred during the performance of this test shall be borne by the Contractor.

**3.10 RESTORATION**

.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects noted by Departmental Representative.

.2 Reinstate areas affected by equipment outside of work area to condition which existed prior to commencement of work and leave site in rake clean condition as directed.

**3.11 SURPLUS MATERIAL**

.1 Surplus suitable material in excavation which is not required in onsite embankments shall be otherwise utilized or disposed of onsite as directed by the Departmental Representative.

.2 In no case shall material be deposited above the established grade without the approval of the Departmental Representative.

.3 No material shall be wasted, unless approved by the Departmental Representative.

.4 Unacceptable excavated topsoil, unacceptable native excavated material, waste material, trash and debris shall be removed and disposed of outside of the National Park boundary.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies requirement for excavating trenches, backfilling and compaction for installation of subsurface infrastructure, such as utility lines and appurtenances.

### 1.2 RELATED WORK

| | | |
|---|---|---|
| .1 | 01 35 29 | Health and Safety Requirements |
| .2 | 01 35 43 | Environmental Procedures |
| .3 | 01 41 00 | Regulatory Requirements |
| .4 | 01 43 00 | Quality Control |
| .5 | 01 51 00 | Temporary Utilities |
| .6 | 01 56 00 | Temporary Barriers and Enclosures |
| .7 | 31 14 13 | Soil Stripping and Stockpiling |
| .8 | 33 05 12 | Sewer Structures |
| .9 | 33 11 16 | Site Water Utility Distribution Piping |
| .10 | 33 31 13 | Public Sanitary Utility Sewerage Piping |

### 1.3 DEFINITIONS

.1 Common excavation (Class II Backfill) is defined as the excavation of all material other than rock, and shall include over-burden over rock, hard pan, quicksand, frozen earth and boulders up to a size of 0.2 $m^3$ or boulders having an average diameter less than 750 mm.

.2 Rock Excavation is divided into two categories; Type A and Type B.

.1 Type A Rock: refers to materials, such as fractured sandstone, shale or ledge rock, which is rippable by a D8 bulldozer or equivalent powered excavator. For open excavation, it refers to materials which, in the opinion of the Departmental Representative, result in:

.1 Substantial delay or decrease in the normal rate of excavation using conventional equipment.

.2 Significant damage or wear to the excavating equipment.

.2 Type B Rock: requires drilling, blasting, wedging or jack hammering to remove, as determined by the Departmental Representative, and cannot be ripped into individual detached masses smaller than 1.5 $m^3$ in size with a single tooth ripper mounted on a D8 bulldozer or equivalent powered excavator as outlined in the Alberta Roadbuilders and Heavy Construction Association Equipment Rental Rates Guide.

.3 All rocks and boulders removed during earthworks, grading and trenching operations, larger than 300 mm diameter, shall be stockpiled wihtin the Campground boundary and reused for landscaping features.

.3 Borrow Area Excavation: Excavation of soil materials in specified borrow areas required by the Contract Documents, excluding topsoil and subsoil stripping.

.4 Waste Excavation is the work involved in excavation, disposing and levelling in designated locations those materials determined to be unsuitable or unstable by the

Departmental Representative and cannot be removed by conventional earthmoving equipment.

.5 Topsoil: The top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding. Shall be reasonably free from subsoil, clay lumps, brush, weeds, waste, cobbles, stumps, roots, and other objectionable material larger than 25 mm in any dimension.

.6 Unsuitable materials consist of:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 Table:

| Sieve Size | % Passing |
|---|---|
| 2.00 mm | 100 |
| 0.10 mm | 45 - 100 |
| 0.02 mm | 10 - 80 |
| 0.005 mm | 0 - 45 |

.3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

.7 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

.8 Class 1 Backfill:

.1 Class 1 backfill shall consist of backfilling the trench with imported sand or gravel compacted to a minimum 98% Standard Proctor Maximum Dry Density within 3% of optimum moisture content in even lifts not exceeding 150 mm in depth.

.2 Unshrinkable fill may be used in lieu of Class 1 backfill.

.9 Native Backfill:

.1 Native backfill shall consist of replacing the excavated trench material to a minimum 98% Standard Proctor Maximum Dry Density within 3% of optimum moisture content in even lifts not exceeding 300 mm in depth.

.10 Borrow Backfill:

.1 Suitable borrow material excavated from designated borrow areas or as directed by the Departmental Representative shall be used to backfill all or portions of excavations resulting from removal of Type A or Type B rock.

## 1.4 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

.1 The location and elevation of existing underground utilities is compiled from records, if available, but is not guaranteed. Notwithstanding any other provision, the Contractor shall be responsible for determining at his expense the actual location and elevation of all sewer, water and gas mains or lines, electric light, power, telephone or telecommunications, conduits, or other such structures or utilities whether or not shown on the plans. The Contractor shall be responsible for notifying the respective utility at

least forty-eight (48) hours in advance of his intention to carry out operations in the vicinity of the said utility and, if required, shall pay for any service supplied for locating of these utilities.

.2 Provide Departmental Representative with proof that utility locates have been requested and all known existing utilities have been marked prior to excavation.

.3 No extra payment will be provided for crossing existing utilities or for special supports for pipelines, cables or poles, or any hand excavation that may be necessary.

.4 If it is necessary to relocate utilities, including poles, because of crossing conflicts with the proposed work, then Parks Canada Agency will be responsible for the payment of the utility relocation. Coordination of the relocation shall be conducted by the Contractor at no cost to Parks Canada Agency.

.5 If it is necessary to relocate utilities, including poles, or structures only to accommodate the Contractor's construction procedure or method, the Contractor shall be responsible for payment of all costs incurred.

.6 Where Work involves breaking into or connecting to existing utilities, carry out work at times directed by the Owner, with minimum of disturbance to users of the services, pedestrian and vehicular traffic.

.7 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active utility service or facility. Adhere to approved schedule and provide notice to affected parties.

.8 Where unknown utilities are encountered, immediately advise Departmental Representative and confirm findings in writing.

.9 Cap or otherwise seal abandoned utilities at cut-off points as shown on the drawings.

.10 Record locations of maintained, re-routed and abandoned utilities indicating horizontal distances and vertical elevations.

.11 Inspect all existing underground and surface structures prior to the commencement of construction, and bring to the attention of the appropriate authority and the Departmental Representative all existing damages. Prior to issuance of the Final Acceptance Certificate, the Contractor shall be responsible for payment for repairs or replacement to correct subsequent damages which may occur.

## 1.5 SOILS INFORMATION

.1 Historical geotechnical reports and test hole logs from within the town site and campground have been referenced by the Engineer for design and preparation of Contract Documents. The reports have been included in Appendix C.

.2 Geotechnical information is made available to the Contractor solely for the purpose of placing the Contractor in receipt of available data, and is not part of the Contract Documents.

.3 No liability is assumed by Parks Canada Agency or Departmental Representatives for the exactness and completeness of these reports.

.4 Contractor shall check field conditions and soil characteristics prior to bidding and report any irregularities or changes in surface or subsurface conditions to Departmental Representative.

.5 Contractor shall make additional examination of the site and soil as they feel necessary in order to satisfy themselves as to the conditions to be encountered. The Contractor shall not carry out additional testing without approval from Departmental Representative.

## 1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 At least 2 weeks prior to commencing work, inform Departmental Representative of proposed source of granular materials or change in source of material.

.3 The Contractor shall provide a sieve analysis of the material for the Departmental Representative's approval.

.4 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.

.5 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

.6 Sand and gravel shall be approved by the Departmental Representative before being used.

.7 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations

.8 Samples:

.1 Submit 1 sample per 500 square meters of road base for each 300 mm lift.

.2 Allow continual sampling by Departmental Representative during production.

.3 Provide Departmental Representative with access to source and processed material for sampling.

.4 Supply new or clean sample bags or containers appropriate for aggregate materials.

.5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

## 1.7 SAFETY REQUIREMENTS

.1 The Contractor will be required to observe all applicable sections of the Alberta Regulations 271/76 made under the Occupational Health and Safety Act covering worker safety in trenches and excavations.

.2 Open cut trenches shall be sheeted and braced as required by the Accident Prevention Regulations of the Occupational Health and Safety Division of the Department of Labour and Municipal Ordinances, and as may be necessary to protect life, property and the work.

.3 Prefabricated cages or shields, provided they conform with all applicable safety requirements, may be used to supplement or replace conventional shoring.

# PART 2. PRODUCTS

## 2.1 MATERIALS

.1 This Section specifies aggregates for utility installations only. For road structure aggregates, refer to Section 32 00 02 Granular Base, 32 11 16.01 Granular Sub-Base and 32 15 40 Crushed Stone Surfacing.

.2 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and detrimental amounts of disintegrated pieces or other deleterious substances.

.3 Flat and elongated particles of coarse aggregate: to ASTM D 4791.

.1 Greatest dimension to exceed 5 times least dimension.

.4 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.2 Reclaimed asphalt pavement or

.3 Reclaimed concrete material.

.5 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock.

.2 Crushed gravel composed of naturally formed particles of stone.

.3 Reclaimed asphalt pavement.

## 2.2 STABILIZING BASE GRAVEL

.1 Stabilizing base gravel shall be used in the trench foundation zone to replace unsuitable native material identified for removal by Departmental Representative.

.2 Stabilizing base gravel shall be well graded gravel consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.3 The material shall meet the following gradation:

| Sieve Size (mm) | Percent Passing (by weight) |
|---|---|
| 40 | 100 |
| 25 | 90 – 100 |
| 20 | 20 – 55 |
| 10 | 0 – 5 |

## 2.3 COMMON BACKFILL

.1 Approved material selected from trench excavation or other source to be used in the Final Backfill zone, unfrozen and free from cinders, ashes, sods, refuse or other deleterious materials.

.2 The maximum size of boulders permitted in backfill shall be 0.02 $m^3$ or 300 mm average diameter.

## 2.4 CLASS I, II AND III BACKFILL MATERIAL

.1 As described in Section 31 23 13 Earthworks and Grading.

## 2.5 PIPE EMBEDMENT MATERIALS:

.1 The pipe embedment zone shall be broken down into foundation, bedding, haunching, and initial backfill as identified in Figure 1 of ASTM Standard Practice D2321 and the drawing detail.

.2 Materials for use as foundation, embedment, and backfill for all pipe material types are as classified in Table 1 of ASTM Standard Practice D2321. They include natural, manufactured, and processed aggregates and the soil types classified according to ASTM Test Method D2487.

.3 Class I, Class II, and Class III pipe embedment materials are suitable for use in the pipe embedment zone subject to the limitations noted herein and in Table 2 of ASTM Standard Practice D2321.

.4 Class IV-A materials should only be used in the embedment zone in special design cases, as they would not normally be construed as a desirable embedment material for flexible pipe.

.5 Class IV-B, Class V Soils, and Frozen Materials are not recommended for embedment, and should be excluded from the final backfill except where specifically allowed by project specifications.

.6 The gradation for bedding sand within the pipe embedment zone shall be within the following limits:

| Sieve Size (mm) | Percent Passing (%) |
|---|---|
| 9.50 | 100 |
| 4.75 | 50 - 100 |
| 2.00 | 30 - 90 |
| 0.425 | 10 - 50 |
| 0.075 | 0 - 12 |

.7 The above material is classified as an ASTM D2321 Class II embedment material.

## 2.6 WASHED GRAVEL

.1 Washed gravel for self-draining curb stops and fire hydrants shall be clean 12.5 mm to 40 mm washed rock meeting the following gradation:

| Sieve Size (mm) | Percent Passing (%) |
|---|---|
| 40 | 100 |
| 25 | 60-100 |
| 20 | 0-75 |
| 12.5 | <7 |

## 2.7 CONCRETE

.1 Concrete required for cradles, Class A bedding, encasement, supports and thrust blocks shall be to CAN A23.1-M90 and shall be 25 MPa CSA A3001 Type HS cement.

## 2.8 FILLCRETE

.1 As described in Section 31 23 13 Earthworks and Grading.

## 2.9 NON-WOVEN GEOSYNTHETIC FILTER FABRIC

.1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls of 4.6 m minimum width and 91 m minimum length.

.2 Composed of minimum 85% by mass of polypropylene fibres which are formed into a stable network such that the fibres retain their relative position, inert to biological degradation and resistant to naturally encountered chemical, alkalis and acids.

.3 Physical properties:

.1 Thickness: to CAN/CGSB-148.1, No.3, minimum 1.9 mm.

.2 Mass per unit area: to CAN/CGSB-148.1, No.2, minimum 217 g/m2.

.3 Tensile strength and elongation in any principal direction: to ASTM D4595.

.4 Grab tensile strength and elongation to CAN/CGSB-148.1, No.7.3.

.1 Breaking force: minimum 0.71 KN, wet condition.

.2 Elongation at future: minimum 50%.

.5 Ball burst strength: to CAN/CGSB-4.2, No.11.2, minimum 0.42 KN, wet condition.

.6 Bursting strength: to CAN/CGSB-148.1, No.6.1 minimum 2100 kPa, wet condition.

.4 Hydraulic properties:

.1 Apparent opening size (AOS): ASTM D4751, 0.212 mm.

.2 Filtration opening size (FOS): CAN/CGSB-148.1 No.10 OPSS 1860.

.3 Permittivity: ASTM D4491, 1.4 sec -1.

.5 Securing pins and washers: [CAN/CSA-G40.21], Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m2 [CAN/CSA G164].

.6 Factory seams sewn in accordance with manufacturer's recommendations.

.7 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

## PART 3. EXECUTION

### 3.1 AGGREGATE PREPARATION

.1 Processing:

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.1 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.

.2 Use methods and equipment approved in writing by Departmental Representative.

.2 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.

.3 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.

.1 Use only equipment approved in writing by Departmental Representative.

.2 Stockpiling:

.1 Aggregates may be stockpiled within the construction boundary of current work zone if space permits, but must not remain when the area is reopened for public use.

.2 Parks Canada Agency will make additional space available for aggregate stockpiles at the Upper Compound, which is approximately 3.5 km from Waterton Townsite Campground.

.3 Stockpile aggregates in sufficient quantities to meet project schedules.

.4 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.5 Material should be stockpiled on hard surfaces to minimize intermixing. Obtain approval from Departmental Representative prior to stockpiling in vegetated areas.

.6 Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work if intermixing has occurred.

.7 Separate different aggregates by strong, full depth bulkheads, or stockpile with sufficient separation to prevent intermixing.

.8 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials within 48 hours of rejection.

.9 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.10 Do not cone piles or spill material over edges of piles.

.11 Do not use conveying stackers.

## 3.2 SITE PREPARATION

.1 The Contractor will be required to strip organic material, clear and grub, remove weeds and grasses as specified or as required by the Departmental Representative prior to excavation. Avoid intermixing of subsoil fill materials with organic material and from other forms of contamination. Stripped material to be stockpiled on site for use in site restoration.

## 3.3 TRENCHING

.1 A standard trench contains vertical walls at a width of 600 mm greater than the outside diameter of the pipe. Where the maximum trench width is exceeded, the Contractor shall, at his own expense, provide special bedding or take other precautions as directed by the Departmental Representative. Where more than one pipe is laid in the same trench, the widths shall be as directed by the Departmental Representative.

.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 be required to use appropriate techniques including trench boxes to keep the width to minimum possible. Every effort shall be made to restrict the trench widths to minimize the area disturbed.

.3 The saw cut width of the pavement shall not exceed the standard trench width shown on the drawings. Anywhere were gravel sloughs out from under pavement, the pavement shall be removed to allow for proper gravel base compaction at the contractors cost.

.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 survey layout stakes.

.5 The trench shall be excavated so that the pipe can be laid to the alignment, grade and depth required.

.6 Trench Rock Excavation:

.1 Where excavation is made in rock or where excavation is made in a material which cannot provide an even, uniform and smooth surface; or where large stones are encountered in the trench, such material shall be removed to provide a clear distance between any part or projection of such material and the surface of all pipe and fittings of not less than 150 mm for 600 mm outside diameter pipe or less, and 200 mm for pipe having an outside diameter greater than 600 mm. The subgrade shall then be made by backfilling with an approved material compacted in 75 mm layers at the Contractor’s expense. The finished subgrade surface shall be shaped by hand tools to provide a uniform and continuous support for the pipe.

.2 Blasting for excavation may be permitted only with the approval of the Departmental Representative and only when proper precautions are taken for the protection of persons and property. The Contractor's method of procedure in blasting shall conform to provincial statutes and municipal ordinances.

.7 The subgrade shall provide a uniform and continuous support for the pipe and fittings on solid undisturbed ground. Any over excavation by the Contractor below the required grade shall be backfilled at his expense with an approved compacted material.

## 3.4 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 of the trench, depth and length ordered by the Departmental Representative and dispose of the material as directed. The subgrade shall then be made by backfilling with an approved stabilizing base 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 shall be wrapped in the non-woven geotextile as specified. The non-woven geotextile shall be overlapped a minimum of 300 mm at all joints to provide a full, continuous wrap and shall be smooth and free of tension, stress, folds, wrinkles or creases.

## 3.5 SHORING

.1 When close sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting. The Departmental Representative reserves the right to order the sheeting driven to the full depth of the trench or to such additional depths as may be required for the protection of the work.

.2 Trench bracing may be removed when the backfilling has reached the respective level of such bracing. Sheeting shall be removed as the backfilling proceeds. Backfilling of holes left by sheeting below the trench bottom shall be carefully compacted, and thereafter backfilling and withdrawal of sheeting shall proceed together. No voids shall be left in the backfill by the withdrawal of the sheeting.

.3 When a cage or shield is used in the trench instead of shoring, special care shall be taken to ensure that there is no lateral or longitudinal movement of the pipe when the

cage is moved. The cage shall be raised vertically so that the bottom member is clear of the crown of the pipe before the cage is pulled forward in the trench.

## 3.6 TRENCH DRAINAGE

.1 Gutters, storm water ditches or natural drainage channels shall not be obstructed. Satisfactory provisions shall be made for alternate drainage where this is impractical.

.2 The trench shall be so drained that the workmen may work safely and effectively. All water encountered in trenches shall be pumped or bailed out, and in no case shall the pipe be used as a drain for such water. Contractor will be required to replace bedding material at these encountered locations, incidental to the original rate. It is essential that the discharge of the trench dewatering pumps be directed as described in the Development Permit and associated Mitigations.

## 3.7 BACKFILLING

.1 Class I or Class II backfill shall be used in trenches.

.2 No boulders, rock, ice, snow, organic material or debris shall be permitted in the trench. These unsuitable materials shall be hauled and disposed of off site.

.3 All surplus excavated material shall also be hauled away, or disposed of as directed by the Departmental Representative. In the event of deficiency of backfill material, suitable material shall be supplied by the Contractor at his expense. Supplied material shall be approved by the Departmental Representative prior to importing to site.

.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 days work. All open trenches to be fenced off at end of day.

## 3.8 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 Departmental Representative shall have the right to request the Contractor to replace any equipment causing unacceptable vibrations. The Contractor is responsible for any damage caused to buildings due to construction.

## 3.9 BACKFILL COMPACTION TESTING

.1 Compaction results shall be based on a minimum of two density tests per 100 linear metres of trench for each 300 mm 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, where 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 his 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 Non-conformity with the specified density or moisture content shall constitute sufficient grounds for rejection of the work.

.5 The cost of all compaction testing will be borne by the Contractor and shall be inclusive of the unit rate for pipe installation.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies requirement for preparing subgrades prior to finishing surface Works, such as concrete, paving and landscaping features.

### 1.2 RELATED WORK

| | | |
|---|---|---|
| .1 | 01 35 29 | Health and Safety Requirements |
| .2 | 01 35 43 | Environmental Procedures |
| .3 | 01 41 00 | Regulatory Requirements |
| .4 | 01 43 00 | Quality Control |
| .5 | 31 14 13 | Soil Stripping and Stockpiling |
| .6 | 31 23 13 | Earthworks and Grading |
| .7 | 31 23 33 | Excavating, Trenching and Backfilling |

### 1.3 DEFINITIONS

.1 Subgrade is the underlying native material located directly below a proposed surface structure, such as road structure, foundation or landscaping materials, which has been worked sufficiently to provide for a stable base. If the native material is unsuitable, it shall be replaced with imported stabilizing material, however, placement will establish the new subgrade layer.

## PART 2. PRODUCTS

### 2.1 NOT USED

## PART 3. EXECUTION

### 3.1 UNSTABLE SUBGRADE

.1 Where the subgrade is unstable, or where it contains materials such as ashes, cinders, refuse, vegetable or organic material, the Contractor shall excavate such material to the width, depth and length ordered by the Departmental Representative and dispose of the material as directed. The subgrade shall then be made by backfilling with approved native material or imported granular material as directed by the Departmental Representative. Material shall be placed in successive layers not exceeding 300 mm in depth and compacted to a minimum of 98% Standard Proctor Maximum Dry Density.

### 3.2 SUBGRADE PREPARATION

.1 The subgrade of all driving surfaces (roads, parking lots, RV sites) shall be scarified and moisture conditioned to 300 mm depth and compacted to a minimum of 98% Standard Proctor Maximum Dry Density at optimum moisture content (± 2%), over the full width of the cross-section.

.2 The subgrade of all non-driving surfaces (pathways, walkways, tent sites and landscape) shall be scarified and moisture conditioned to 150 mm depth and compacted to a minimum of 98% Standard Proctor Maximum Dry Density at optimum moisture content (± 2%), over the full width of the cross-section.

.3 The material shall be worked to ensure as much uniformity as possible in material.

.4 Water shall be added or the material shall be aerated to bring the moisture content to optimum value. The supply of water shall be the responsibility of the Contractor.

**3.3 COMPACTION**

.1 Field tests for density and moisture content shall be conducted by the Contractor.

.2 Trench backfill encountered in the preparation of the subgrade which has not been compacted sufficiently shall be excavated and re-compacted as specified at the Contractors expense.

**3.4 TESTING COMPACTION**

.1 Compaction results shall be based on a minimum of one density test per 500 square meters of prepared subgrade area. Additional tests may be called for by the Quality Control Agency or by the Departmental Representative as deemed necessary.

.2 Field density tests shall conform to ASTM D1556, ASTM D2167, or ASTM D6938 for comparison with a maximum density determined according to ASTM D698 Method A.

**3.5 PROOF ROLLING**

.1 When required by the Departmental Representative, the Contractor shall supply and operate a loaded test vehicle of 8,200 kg axle load to test the subgrade for rutting, weaving and soft spots.

.2 Where proof rolling indicates areas that are defective, the Contractor shall remove and replace the material with suitable compacted material. Proof rolling shall be considered incidental to the subgrade construction.

**3.6 TOLERANCES**

.1 The finished surface of the subgrade shall conform to grades approved by the Departmental Representative, and shall show no depression more than 15 mm under a straightedge 3.0 m long when placed parallel to the centreline. Subgrade higher than the approved grades shall be cut to the required grades.

.2 The tolerance for ditches, boulevards, etc., shall be ±30 mm.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies requirement for granular base course gravel to be used in the asphalt road and concrete pad structures.

### 1.2 RELATED WORK

| | | |
|---|---|---|
| .1 | 01 35 29 | Health and Safety Requirements |
| .2 | 01 35 43 | Environmental Procedures |
| .3 | 01 43 00 | Quality Control |
| .4 | 31 23 13 | Earthworks and Grading |
| .5 | 32 00 01 | Subgrade Preparation |
| .6 | 32 00 03 | Asphalt Concrete Pavement |
| .7 | 32 11 16.01 | Granular Sub-Base |
| .8 | 32 12 13.16 | Asphalt Prime and Tack Coats |
| .9 | 32 15 60 | Roadway Dust Control |
| .10 | 32 16 15 | Concrete Walks, Curbs and Gutters |

### 1.3 SUBMITTALS

.1 At least two (2) weeks prior to commencing work, provide:

.1 Test data reports representing granular base and/or granular sub-base processed into stockpile. Submit one (1) complete aggregate gradation analysis report for every 1,000 tonnes of each material required for the project or one complete analysis for each production day when production is less than 1,000 tonnes.

.2 Sieve analysis of the material.

.3 The gradation curve developed shall be free from acute changes.

.4 Include percentage of crushed coarse aggregate particles in granular base reports.

.5 Certification that the physical properties of the aggregates meet the requirements of this section.

.6 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.

.2 At least two (2) weeks prior to contemplated change in source of aggregates, provide written notification to the Departmental Representative and provide new materials certification in accordance with the requirements of this section.

.3 Preliminary review of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for

traffic. Rejected material will not be paid for. The Departmental Representative has the right to request additional testing if there are any concerns with the proposed aggregate.

### 1.4 QUALITY ASSURANCE

.1 In accordance with section 01 43 00 Quality Control

## PART 2. PRODUCTS

### 2.1 GRANULAR BASE

.1 Material for the granular base course shall consist of sound, hard, durable crushed rock or crushed gravel and shall not contain organic or soft, thin, elongated, or laminated materials, materials that break up when alternately frozen and thawed or wetted and dried, or other deleterious materials.

.2 When compacted near the optimum moisture content to not less than 100% of the maximum dry density corrected for the stone content as determined by ASTM D698, the material shall have a minimum bearing ratio as defined by ASTM D1883 of fifty-five percent (55%).

.3 Granular base course shall meet the following gradation when tested to ASTM C136 and ASTM C117, and give a smooth curve without sharp breaks when plotted on a semi-log grading chart:

| Sieve Size | Percent Passing (by weight) |
|---|---|
| 25 mm | 100 |
| 20 mm | 95 - 100 |
| 10 mm | 55 - 80 |
| 5 mm | 35 - 65 |
| 2.5 mm | 28 - 52 |
| 630 µm | 13 - 35 |
| 315 µm | 9 - 26 |
| 160 µm | 6 - 18 |
| 80 µm | 4 - 10 |

.4 At least 50 percent by weight of material retained on the #4 sieve shall have two or more fractured faces.

.5 The liquid limit shall not exceed 25 and the plasticity index shall not exceed 6 for the portion of material passing the 1,000 sieve.

## PART 3. EXECUTION

### 3.1 PLACING

.1 The base material shall not be placed until the underlying course has been accepted by the Departmental Representative.

.2 The granular material shall be placed in uniform layers not exceeding 150 mm in compacted thickness.

.3 The material shall be placed by mechanical spreaders or deposited in windrows and levelled with suitable equipment.

.4 Shape each layer to a smooth contour and compact to specified density.

## 3.2 COMPACTION

.1 Each layer of granular base course shall be compacted near the optimum moisture (+/- 2%) content to not less than 100% of the maximum dry density corrected for the stone content as determined by ASTM D698 Method A for the material used.

.2 During compaction, the moisture content shall be maintained at the optimum moisture content as determined by ASTM D698. If the moisture content exceeds the optimum moisture content the material shall be aerated by mechanical means until the material has dried sufficiently to reach the optimum moisture content. Water shall be added if the moisture content is below optimum.

## 3.3 TESTING COMPACTION

.1 Compaction results shall be based on a minimum of one density test per 500 square meters of road per each lift. Additional tests may be called for by the Departmental Representative as deemed necessary.

.2 Field density tests shall conform to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A.

## 3.4 SHAPING AND FINISHING

.1 The finished surface of the granular base course shall conform to grades approved by the Departmental Representative, and shall show no depression more than 5 mm under a straight edge 3.0 m long placed parallel to the road centreline. Granular base course higher than the approved grades shall be cut to the required grades.

## 3.5 INSPECTION

.1 Before acceptance by the Departmental Representative the granular base course surface shall be true to cross-section and grade, shall conform to the density and bearing ratio requirements specified.

.2 Field density and moisture content tests will be made by the Departmental Representative or his representative to ensure that the material is satisfactory. Material not meeting the specification requirements will not be approved.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies requirements for asphalt concrete pavement for roads within the project area.

### 1.2 RELATED WORK

| | | |
|---|---|---|
| .1 | 01 35 29 | Health and Safety Requirements |
| .2 | 01 35 43 | Environmental Procedures |
| .3 | 01 43 00 | Quality Control |
| .4 | 31 23 13 | Earthworks and Grading |
| .5 | 32 00 01 | Subgrade Preparation |
| .6 | 32 00 02 | Granular Base |
| .7 | 32 11 13 | Reshaping Granular Road Bed |
| .8 | 32 11 16.01 | Granular Sub-Base |
| .9 | 32 12 13 | Asphalt Prime and Tack Coats |
| .10 | 32 15 60 | Roadway Dust Control |
| .11 | 32 16 15 | Concrete Walks, Curbs and Gutters |
| .12 | 33 05 14 | Adjustment of Manholes, Hydrants and Water Valves |

### 1.3 DEFINITIONS

.1 Overlay: Paving over an existing pavement for rehabilitation purposes and not as part of full pavement replacement.

.2 Staged Paving: Paving where a lift or lifts that form part of the total pavement structure are deferred to a future date.

.3 Mix Types: Mixes are designated according to use as follows:

.1 Mix “A” Asphalt – base course asphalt.

.2 Mix “B” Asphalt – surface course and overlay asphalt.

### 1.4 SUBMITTALS

.1 The Contractor shall submit asphalt concrete mix design based on the Marshall Method and trial mix test results to the Departmental Representative for review at least 2 weeks prior to commencing work.

.2 Asphalt concrete mix design and a minimum 60 kg sample of the mix shall be submitted to the Departmental Representative 48 hours prior to any mix being used.

.3 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.

.4 Preliminary review of the material as represented by the samples shall not constitute general acceptance of all material or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction or if the material fails to provide a pavement suitable for traffic. Rejected

material will not be paid for. The Departmental Representative has the right to request additional testing if there are any concerns with the proposed aggregate mix design.

### 1.5 QUALITY ASSURANCE

.1 In accordance with section 01 43 00 Quality Control

## PART 2. PRODUCTS

### 2.1 MIX 'A' AND MIX 'B' ASPHALT

.1 The aggregate, mineral filler, asphaltic binder, and mix design for this project shall be in accordance with Section 307.00.00, 2015 City of Calgary Standard Specifications, Roads Construction. Refer to **Appendix A** for detailed specification.

## PART 3. EXECUTION

### 3.1 PREPARATION

.1 Patch and correct depressions and other irregularities to approval of the Departmental Representative before beginning paving operations. Prior to laying mix, clean surfaces of loose and foreign material and apply tack coat in accordance with Section 32 12 13.16 – Asphalt Tack Coats.

.2 All asphalt surfaces shall be clean pavement edges free from encroaching vegetation.

### 3.2 MIX TOLERANCES

.1 All mixture furnished shall conform to City of Calgary Standard Specifications, Roads Construction (latest issue) and meet specified tolerances.

### 3.3 MIXING PLANT

.1 The mixing plant and auxiliary equipment shall be as such to combine, dry and heat the mineral aggregate, heat the asphalt and accurately proportion the asphalt and aggregate to produce a uniform mixture in accordance with these specifications.

.2 All asphalt mixing plants shall be registered with Alberta Environmental Protection and shall be operated in accordance with the "Code of Practice for Asphalt Plants".

### 3.4 TRANSPORTATION OF MIX

.1 The mixture shall be transported from the mixing plant to the work in vehicles with tight metal bottoms previously cleaned of all foreign materials. The vehicle shall be suitably insulated and each load shall be covered with canvas or other suitable material of sufficient size to protect it from weather conditions. The inside surface of all vehicles may be lightly lubricated with a thin oil or soap solution prior to loading but excess lubricating will not be permitted.

.2 Any accumulation of asphaltic material which was collected in the box shall be thoroughly cleaned before loading with hot mix.

.3 Trucks shall be maintained perfectly clean of mud or any substance which could contaminate the working area.

### 3.5 EQUIPMENT

.1 Pavers:

.1 Mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Roller:

.1 The rollers used for compaction shall be self-propelled steel-wheeled or rubber-tired rollers, providing at least 35 Newtons per millimetre width of tread. The roller shall be in good condition without backlash when reversed and shall be operated by competent rollermen. The wheels shall be kept properly moistened, but excess water or oil will not be permitted.

.3 Hand Tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

## 3.6 PLACING

.1 Obtain Departmental Representative's approval of base and existing surface and tack coat and prime coat prior to placing asphalt. Asphaltic concrete shall be laid in lifts to the design thickness applicable to the project. Lift thickness shall not exceed 60 mm.

.2 Place asphalt concrete to thicknesses, grades and lines indicated or directed by Departmental Representative.

.3 Placing Conditions:

.1 No asphalt shall be dispatched to the field unless local temperature, as issued by the Atmospheric Environmental Service, meets the requirements of the following table:

| Depth of Asphalt | Minimum Air Temperature |
|---|---|
| Surface lift (<50 mm) | 15°C |
| 60 mm lift | 4°C and rising |

.1 A 2°C tolerance shall be permitted for plant start-up temperatures.

.2 No asphalt shall be placed on or against any surface, which is at a temperature of less than 5°C.

.3 When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.

.4 Do not place hot mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

.4 Mixtures shall be spread at temperatures which, when measured in the hopper of the spreader, are:

.1 115°C to 150°C for an air temperature above 15°C

.2 140°C to 160°C for an air temperature below 15°C

.5 In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Departmental Representative. The material shall be distributed uniformly to avoid segregation of the coarse and fine aggregates. Broadcasting of material shall not be permitted. During the spreading operation, all material shall be thoroughly loosened and uniformly distributed by lutes or rakes. Material that has formed into lumps and does not break down readily shall be rejected.

.6 Areas which are deemed likely to have vehicles, the pavement edge should have pavement edge sloped to protect pavement edge from damage. These areas are required to be indicated in the field by the Departmental Representative.

## 3.7 ROLLING AND COMPACTION

.1 Before rolling is started, the surface shall be checked, inequalities in depth adjusted or sandy accumulations replaced and irregularities in alignment or grade along the outside edge shall be corrected.

.2 The rollers must be kept in continuous operation as nearly as practicable and all parts of the pavement shall receive substantially the same compaction. Rolling shall be done at a maximum speed of 5 km per hour.

.3 At least one roller shall be used for every 40 tonnes of asphaltic concrete laid per hour. Rolling shall start as soon as the pavement will bear the roller without checking or undue displacement, working from the low part or edge to the high part or edge continuously until no roller marks are left in the finished surface and no further compaction is possible. Where width permits the pavement shall be rolled diagonally in two directions. At all curbs, manholes and other appurtenances, and at all locations not accessible to the rollers, hand tampers shall be used to produce the same density as provided by the roller. Where the asphaltic concrete is laid in more than one lift, each lift shall be so compacted.

.4 Required Density: Each mat of hot mix placed shall be compacted to the following minimum density (% of Marshall density) for the type of paving, or as indicated in Special Provisions.

| Minimum Density | Type of Paving |
|---|---|
| 98% | New paving and all stages in staged paving except 2nd stage mix B ≤ 40mm |
| 96% | Second stage residential material ≤ 40mm |

## 3.8 JOINTS

.1 The mixture shall be laid so that all longitudinal joints are made while the first mat of the two being laid is still warm and shall be well bonded, sealed and finished to provide a continuous and smooth profile across the joint.

.2 Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth-riding surface. Joints shall be straight-edged to assure smoothness and true alignment. The vertical face shall be treated with freshly laid mixture raked against it, tamped with hot tampers and rolled. Heat shall be used as necessary to ensure a proper bond.

.3 Paving joints shall not be placed in the same vertical plane. Longitudinal joints shall be offset at least 75 mm and transverse joints in succeeding courses shall be offset at least 600 mm.

.4 Joints in the surface course shall be offset a minimum of 300 mm beyond the limit of proposed lane markings.

.5 Edges against which additional pavement is placed shall be vertically formed to true line. In making the joint along any adjoining edge such as curb, gutter or an adjoining pavement and after the hot mixture is placed by the finishing machine, enough material shall be carried back to fill any space left open.

.6 The exposed edges of all cold asphalt joints and the face of concrete gutter shall be cleaned and painted with a thin coat of hot asphalt cement. When the ambient air temperature is less than 10° Celsius, joints shall be heated using an infrared heater prior to painting with hot asphalt cement.

.7 Where a transverse joint is made with a cold asphalt mat, the joint shall be made on a vertically true line. Cold jointing shall be done in such a manner as to ensure a thorough and continuous bond between the cold and the hot mats.

.8 Cold asphalt shall be one where the surface temperature, taken within 600 mm of the edge of the mat, is less than 65° Celsius.

**3.9 FINISH**

.1 The finished pavement shall be true to the required profile and cross-section. Tests of pavement profile and thickness shall be made after the first layer of asphalt has been placed, and depressions or bumps in excess of 5 mm shall be corrected. The allowable tolerance for finished pavement shall be ±5 mm, and the surface shall show no depressions or bumps exceeding 3 mm under a straight-edge 3 m long placed parallel to the road centreline.

.2 Gravel or soil material adjacent to pavement edge shall be adequately placed and compacted directly alongside road edge as specified in road section details.

**3.10 DEFECTIVE WORK**

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.

.2 Repair areas showing checking or hairline cracking.

**3.11 TESTING AND INSPECTION**

.1 The Departmental Representative or his representative shall retain core samples from the completed pavement, from which depth of pavement and density tests shall be made.

.2 One core shall be taken for approximately every 1500 $m^2$ of asphalt or at least once each day during placing operations. The following tests shall be carried out:

.1 Marshall stability (test for resistance of plastic flow of bituminous mixtures) using Marshall Apparatus as per ASTM D1559.

.2 Sieve analysis of extracted aggregates in accordance with ASTM C136 and entire washed sample in accordance with ASTM C117.

.3 Bulk specific gravity of compacted mixtures in accordance with ASTM D2726.

.4 Bitumen content of paving mixtures in accordance with ASTM D2172.

.5 Percent voids in the mineral aggregates (VMA) is to be calculated on the basis of ASTM D2726 Bulk Specific Gravity of the aggregate.

.6 Air voids in compacted mix in accordance with ASTM D3203.

.3 The Contractor shall repair all test holes with fresh, hot mix asphaltic concrete mixture, and thoroughly compact it to the required density with no additional compensation.

**3.12 PENALTIES**

.1 Thickness:

.1 If a deficiency in thickness is found, two more cores shall be taken in the area, and the average thickness of the three cores shall represent the area. The Contract Unit Price shall be adjusted as follows for areas deficient in thickness.

.1 No payment shall be made for asphaltic surface course deficient in thickness by 13 mm or more.

.2 If the surface course is found deficient by more than 3 mm but less than 13 mm, then the adjusted unit price shall have the same ratio to the contract unit price that the square of the average thickness found has to the square of the specified thickness.

.2 No price adjustment shall be made for surface course found to be deficient by less than 3 mm or any thicker than specified.

.2 Density:

.1 The cores will also be used to determine density. If any test fails to meet the density specified, two more cores shall be taken in the area, and the average density of the three cores shall represent the area. If the densities are less than specified, the Contract Unit Price shall be adjusted as follows:

| **ASPHALT DENSITY PAY FACTORS** | | | | | |
|---|---|---|---|---|---|
| **98% Required** | | **97% Required** | | **96% Required** | |
| **Actual Density %** | **Pay Factor %** | **Actual Density %** | **Pay Factor %** | **Actual Density %** | **Pay Factor %** |
| 98.0 | 100.0 | 97.0 | 100.0 | 96.0 | 100.0 |
| 97.9 | 99.9 | 96.9 | 99.9 | 95.9 | 99.7 |
| 97.8 | 99.8 | 96.8 | 99.7 | 95.8 | 99.3 |
| 97.7 | 99.6 | 96.7 | 99.4 | 95.7 | 98.9 |
| 97.6 | 99.4 | 96.6 | 99.1 | 95.6 | 98.4 |
| 97.5 | 99.1 | 96.5 | 98.7 | 95.5 | 97.8 |
| 97.4 | 98.7 | 96.4 | 98.2 | 95.4 | 97.1 |
| 97.3 | 98.3 | 96.3 | 97.7 | 95.3 | 96.4 |
| 97.2 | 97.8 | 96.2 | 97.1 | 95.2 | 95.6 |
| 97.1 | 97.2 | 96.1 | 96.3 | 95.1 | 94.6 |
| 97.0 | 96.5 | 96.0 | 95.5 | 95.0 | 93.4 |
| 96.9 | 95.8 | 95.9 | 94.6 | 94.9 | 92.2 |
| 96.8 | 95.0 | 95.8 | 93.6 | 94.8 | 90.7 |
| 96.7 | 94.2 | 95.7 | 92.5 | 94.7 | 89.1 |
| 96.6 | 93.3 | 95.6 | 91.3 | 94.6 | 87.3 |
| 96.5 | 92.3 | 95.5 | 89.9 | 94.5 | 85.1 |
| 96.4 | 91.1 | 95.4 | 88.4 | 94.4 | 82.6 |
| 96.3 | 89.8 | 95.3 | 86.7 | 94.3 | 79.5 |
| 96.2 | 88.5 | 95.2 | 84.8 | 94.2 | 75.5 |
| 96.1 | 87.1 | 95.1 | 82.7 | 94.1 | 69.7 |
| 96.0 | 85.5 | 95.0 | 80.3 | 94.0 | 60.0 |
| 95.9 | 83.8 | 94.9 | 77.6 | Under 94.0 | Reject |
| 95.8 | 82.0 | 94.8 | 74.3 | | |
| 95.7 | 80.0 | 94.7 | 70.6 | | |
| 95.6 | 77.7 | 94.6 | 66.0 | | |
| 95.5 | 75.4 | 94.5 | 60.0 | | |
| 95.4 | 73.0 | Under 94.5 | Reject | | |
| 95.3 | 70.3 | | | | |
| 95.2 | 67.2 | | | | |
| 95.1 | 63.7 | | | | |
| 95.0 | 60.0 | | | | |
| Under 95.0 | Reject | | | | |

Actual Density = % of Marshall density.
Pay Factor = % of contract price.

## 3.13 ACCEPTANCE

.1 Locations shall be cleared of all excess material resulting from the paving operation and any damage caused by the Contractor shall be repaired to the Departmental Representative's satisfaction within 3 days of the date of completion of the street or lane. Failure to clean-up or repair damage may result in other crews undertaking this work without notice to the Contractor and deducting the costs from money due to the Contractor.

.2 No traffic shall be allowed on the finished surface until it has cooled to atmospheric temperature.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED WORK

.1 All landscape development sections including 32 91 19.13 - Topsoil Placement and Grading, 32 91 19.14 – Seeding and 32 93 10 – Trees, Shrubs and Ground Cover Planting.

### 1.2 WARRANTIES

.1 The provisions of this Landscape Maintenance Specification are in addition to and in no way detract from or limit general warranty provisions of the Contract.

## PART 2. PRODUCTS

### 2.1 NOT USED

## PART 3. EXECUTION

### 3.1 MAINTENANCE PERIOD

.1 Unless otherwise specified the Contractor shall be responsible for regular weekly maintenance of landscaped areas from the date of Substantial Performance unless otherwise stated in the tender documents:

.1 Sod for a period of one (1) year

.2 Trees, shrubs, and seeded areas for a period of one (1) year

### 3.2 SCHEDULING AND MONITORING

.1 Provide watering service within 24 hours, weeding service within 48 hours, and reseeding within five days of request by the Departmental Representative.

.2 Contractor shall maintain a log noting dates, times, maintenance performed, condition of site, and any other related information. The Contractor shall notify the Departmental Representative of the time the Contractor proposes to commence each application.

.3 The Contractor shall provide the updated maintenance log to the Departmental Representative once per month.

### 3.3 CLEAN UP

.1 All areas shall be kept clean and free of refuse, debris, garbage, stones, bottles, etc. All paved areas shall be swept when necessary or when so directed by the Departmental Representative.

### 3.4 SEEDED AREAS

.1 Ensure maintenance equipment suitable to Departmental Representative.

.2 Perform operations from time of seed application until acceptance by Departmental Representative.

.3 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass and to ensure moisture penetration of 75 to 100mm. Control watering to prevent washouts. Water every four to seven days for the first month if no rain. Do not water in second or third month unless there has been less than 25mm (1”) of rain for 4

weeks. Water will encourage weed growth; established native seedlings can withstand drought and gives the plants an advantage over weeds and other grasses.

.4 Do not water areas seeded in the fall.

.5 Repair and reseed dead or bare spots as soon as possible to allow establishment of grasses prior to acceptance.

.6 Maintain grass free of pests and diseases utilizing acceptable integrated pest management practices.

.7 Control weeds by cutting flower heads prior to forming seed. Set mower blades high, approximately 150 to 200mm, to cut flower heads but not the native grasses which will be very short in the first year. This may need to be done every second week depending on extent of weeds present.

.8 Hand weeding of perennial weeds should be considered for smaller areas with few weeds.

## 3.5 TREE AND SHRUB MAINTENANCE

.1 The Contractor is responsible for pruning and guying the trees and maintaining the trees and shrubs after planting. Maintenance shall include watering, pruning, weeding, cultivating, mulching, checking wires, ties, etc. as well as control of insects, fungi, and other diseases by means of spraying with an approved insecticide or fungicide. Spray Operator must possess current Pesticide Applicator license.

.2 Replace dead trees and shrubs in a timely manner. Trees and shrubs requiring replacement from previous year's installation to be planted by June 15 the following year. Trees and shrubs which die through the normal growing season to be replaced by October 15 the same year of installation.

.3 Remove all tree staking at the time the one year maintenance and guarantee period expires, except for tree replacements.

.4 Contractor is responsible for tree and shrub protection from animal damage. Ensure that tree protection fencing are appropriately placed and installed.

## 3.6 WATERING TREES AND SHRUBS

.1 All plant material shall be watered weekly or as required to keep the ground in a continually moist condition from the top surface to 300 mm depth.

.2 Shrubs and trees shall be individually watered.

.3 Parks Canada Agency shall review and approve the Contractors watering schedule and be notified during watering operations.

## 3.7 PRUNING

.1 Prune all trees and shrubs in accordance with standard horticultural practice to preserve natural character of plant. Pruning shall be done with clean, sharp tools.

.2 Prune to remove dead, diseased, injured, broken, rubbing, and crowded limbs.

.3 Tree pruning to be carried out by qualified tree pruner or qualified arborist.

.4 Prune to take advantage of the plant's growth habit, accentuating its natural tendencies, seldom modifying them.

.5 Prune all suckers from the base, trunk, and inside crown of tree. All injured tree and shrub roots shall be pruned to make clean ends before planting.

.6 Each cut should be made carefully, at the correct location, leaving a smooth surface with no jagged edges or torn bark. Pruning cuts should be located to leave a wound of the smallest diameter.

.7 The correct location to make the cut is beyond the branch collar or shoulder.

.8 Prune to ensure that there is a central leader on coniferous trees.

.9 As a rule, growth is maximized if pruning is done just before the period of rapid growth, in early spring. Prune at the proper times according the plant requirements as follows:

.1 Shade trees from October 15 to April 15 except Birch.

.2 Birch from June 15 to July 15.

.3 Conifers from April 15 to May 15.

**END OF SPECIFICATION**

## PART 1. GENERAL

.1 This Section specifies requirements for scarifying and reshaping of existing granular roads and lanes with addition of new granular base material where required, to lines, grades, and typical cross section as indicated on drawings.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Granular base aggregate to be in accordance with Section 31 05 16, Aggregate Material.

## PART 3. EXECUTION

### 3.1 WASTE EXCAVATION

.1 Remove contaminated gravel, clay, and other deleterious material and haul to designated waste disposal site.

### 3.2 SCARIFYING AND RESHAPING

.1 Scarify remaining granular base material as indicated on drawings.

.2 Blade and trim scarified material to elevation and cross section dimensions indicated or as directed by Departmental Representative.

.3 Where a deficiency of material exists, add and blend in new granular base material.

### 3.3 COMPACTION

.1 Compact to a density not less than 100% Standard Proctor Density.

.2 Shape and roll alternately to obtain smooth, even, and uniformly compacted base.

.3 Apply water as necessary during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.

### 3.4 TOLERANCE

.1 Reshaped compacted surface shall be within ± 10 mm of elevation as indicated on the approved drawings.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies requirements for granular sub-base course gravel to be used in the roadway, pathway and concrete pad structures.

### 1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft$^3$) (600 kN-m/m$^3$).

.4 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft$^3$) (2,700 kN-m/m$^3$).

.5 ASTM D4318, Standard Test Methods for Liquid Unit, Plastic Unit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

### 1.3 RELATED WORK

| | | |
|---|---|---|
| .1 | 01 35 29 | Health and Safety Requirements |
| .2 | 01 35 43 | Environmental Procedures |
| .3 | 01 43 00 | Quality Control |
| .4 | 31 23 13 | Earthworks and Grading |
| .5 | 32 00 01 | Subgrade Preparation |
| .6 | 32 00 03 | Asphalt Concrete Pavement |
| .7 | 32 11 16.01 | Granular Sub-Base |

### 1.4 SUBMITTALS

.1 At least two (2) weeks prior to commencing work, provide:

.1 Test data reports representing granular sub-base processed into stockpile. Submit one (1) complete aggregate gradation analysis report for every 1,000 tonnes of each material required for the project or one complete analysis for each production day when production is less than 1,000 tonnes.

.2 Sieve analysis of the material.

.3 The gradation curve developed shall be free from acute changes.

.4 Include percentage of crushed coarse aggregate particles in granular base reports.

.5 Certification that the physical properties of the aggregates meet the requirements of this section.

.6 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.

.2 At least two (2) weeks prior to contemplated change in source of aggregates, provide written notification to the Departmental Representative and provide new materials certification in accordance with the requirements of this section.

.3 Preliminary review of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. Rejected material will not be paid for. The Departmental Representative has the right to request additional testing if there are any concerns with the proposed aggregate.

## 1.5 QUALITY ASSURANCE

.1 In accordance with section 01 43 00 Quality Control

# PART 2. PRODUCTS

## 2.1 MATERIALS

.1 Granular sub-base material shall conform to the following criteria:

.1 Crushed pit run, screened stone, gravel, sand or recycled asphalt pavement.

.2 Granulations to be within limits specified when tested to ASTM C136 and ASTM C117 - sieve sizes to CAN/CGSB-8.1.

| Sieve Size (mm) | Percent Passing (%) |
|---|---|
| 100 | 100 |
| 80 | 100 |
| 40 | 60 -90 |
| 20 | 40-70 |
| 10 | 25-60 |
| 5.0 | 15-25 |
| 2.5 | 10-35 |
| 0.63 | 5-23 |
| 0.08 mm | 0-5 |

.3 Other properties as follows:

.1 % Fracture, by weight (2 faces) - 20 min

.2 Los Angeles Abrasion, loss, % - 45 max.

.3 Liquid limit: to ASTM D4318, maximum 25

.4 Plasticity index: to ASTM D4318, maximum 6

.5 CBR when compacted to 100% of ASTM D698 - 40 min

## PART 3. EXECUTION

### 3.1 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.

.2 Construct granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 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 98% corrected maximum dry density ASTM D698.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### 3.3 SITE TOLERANCES

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

### 3.4 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DEFINITIONS

.1 Prime Coat:

.1 Prime coat shall be the application of bituminous material to previously prepared subgrade or granular base course, preparatory to placing bituminous surfacing materials or asphaltic concrete base course.

.2 Tack Coat:

.1 Tack coat shall be the application of bituminous material to a previously constructed paving surface of any type in preparation of placing bituminous surfacing materials.

## PART 2. PRODUCTS

### 2.1 PRIME COAT

.1 The bituminous material for priming the base course shall be liquid asphalt. The asphalt types shall be slow setting (SS) type SS-1 to SS-1H or a special emulsified asphalt primer S.E.P. 1 depending on conditions to suit the base.

### 2.2 TACK COAT

.1 The bituminous material for tacking the existing asphalt surface shall be liquid asphalt. The asphalt types shall be a slow setting (SS) type SS-1 to SS-1H depending on conditions to suit the base and time of season.

### 2.3 SAND BLOTTER

.1 The materials for sand cover shall consist of clean granular mineral material approved by the Departmental Representative, all of which shall pass a 5,000 sieve.

## PART 3. EXECUTION

### 3.1 EQUIPMENT

.1 Cleaning equipment shall consist of power brooms, flushers, and whatever hand scrapers may be necessary to remove all foreign material.

.2 The pressure distributor used for applying asphaltic material shall distribute the asphaltic material at an even temperature, uniformly on variable widths of surface up to 5 metres. Uniform spray without atomization shall be determined and controlled from 0.2 to 5.4 litres per minute (L/m) with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m.

.3 Suitable means for accurately indicating the temperature of the asphaltic material shall be provided at all times. The thermometer well shall be so placed as not to be in contact with a heating tube.

.4 If provided with heating attachments the distributor shall be so equipped and operated that the asphaltic material shall be circulated or agitated throughout the entire heating process.

### 3.2 PREPARATION

.1 Immediately prior to applying the asphalt primer, tack or fog coat, the surface shall be brought to uniform cross-section by patching all depressions and defective areas using an approved patching material and by removing all bumps and irregularities. Asphalt surface must be dry prior to application.

.2 All loose and foreign material shall be removed by light sweeping.

## 3.3 APPLICATION

.1 Obtain Departmental Representative's approval of existing surface before applying asphalt prime, tack or fog coats. Clean surface as required.

.2 Upon the prepared surface the asphalt shall be applied uniformly at a rate of from 2.0 litres/square metre ($L/m^2$) for asphalt primer, and at a rate of from 0.5 $L/m^2$ for tack coat. The asphalt primer, tack or fog coat shall be applied only when the surface is dry or slightly damp, unless otherwise allowed by the Departmental Representative in writing.

.3 The application temperature of the asphalt primer, tack or fog coat shall be as follows:

.1 Medium Curing Asphalt:

| | |
|---|---|
| MC-30 | 51 - 68°C |
| MC-70 | 74 - 88°C |
| MC-250 | 100 - 110°C |

.2 Emulsified Asphalt:

| | |
|---|---|
| SS-1 | 20 - 50°C |
| SS-1H | 20 - 50°C |

.3 Emulsified Asphalt Primer: 15 - 50°C

.4 Coat contact surfaces of curbs, gutters, headers, manholes and like structures with a thin uniform coat of asphalt material. Do not prime or tack surfaces that will be visible when paving is complete. Work adjacent to the roadway shall be completely protected from the application operation by a suitable covering. Any unnecessary splashing of the concrete shall be cleaned.

.5 Do not apply asphalt coat when air temperature is less than 5°C or when rain is forecast within 2 hours.

.6 The Contractor shall maintain the primed surface until the surface course has been placed. Maintenance shall include spreading any additional sand and patching any breaks in the primed surface with additional asphaltic material.

.7 The asphalt primer should preferably be entirely absorbed by the base course and therefore require no sand cover. If, however, the asphalt has not been completely absorbed 24 hours after application, sufficient sand shall be spread over the surface to blot up excess asphalt and prevent it from being picked up by any traffic.

.8 Traffic shall not be permitted to travel on tack or fog coat until cured. The Contractor shall use flagmen, if required, and signage to control traffic until the tack or fog coat has cured.

.9 Traffic shall not be permitted to travel on prime coat until 6 hours after application or until it has cured. After this period of time, excess asphalt material remaining on the surface shall be blotted by sand before traffic is permitted to travel on the surface.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies Work for the preparation, stockpiling, hauling, placing, and compacting of crushed stone surfacing material as indicated on the drawings and specified herein.

### 1.2 RELATED WORK

| | | |
|---|---|---|
| .1 | 01 35 29 | Health and Safety Requirements |
| .2 | 01 35 43 | Environmental Procedures |
| .3 | 01 43 00 | Quality Control |
| .4 | 31 23 13 | Earthworks and Grading |
| .5 | 32 00 01 | Subgrade Preparation |
| .6 | 32 11 16.01 | Granular Sub-Base |

### 1.3 REFERENCES

.1 American Association of State Highway and Transportation Officials (AASHTO):

.1 M147, Standard Specification for Materials for Aggregate and Soil Aggregate Subbase, Base, and Surface Courses.

.2 T11, Standard Method of Test for Materials Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 T27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates.

.4 T89, Standard Specification for Determining the Liquid Limit of Soils.

.5 T90, Standard Specification for Determining the Plastic Limit and Plasticity Index of Soils.

.6 T96, Standard Specification for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.7 T99, Standard Specification for the Moisture-Density Relations of Soils Using a 2.5 kg (5.5 pound) Rammer and a 305 mm (12 in) Drop.

.8 T180, Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18-in) Drop.

.9 T190, Standard Specification for Resistance R-Value and Expansion Pressure of Compacted Soils.

.10 T265, Standard Method of Test for Laboratory Determination of Moisture Content of Soils.

.11 T310, Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

.2 ASTM International (ASTM):

.1 C136, Standard Test Method for Sieve Analysis of fine and Coarse Aggregates

.2 D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft 3 (600 kN-m/m 3 )).

.3 D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft 3 (2,700 kN-m/m 3 )).

.4 C88, Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate. surfacing crushed stone

.5 D1883, Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.6 D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.7 D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

.8 D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

## 1.4 SUBMITTALS

.1 At least two (2) weeks prior to commencing work, provide:

.1 Test data reports representing granular material processed into stockpile. Submit one (1) complete aggregate gradation analysis report for every 1,000 tonnes of each material required for the project or one complete analysis for each production day when production is less than 1,000 tonnes.

.2 Sieve analysis of the material.

.3 The gradation curve developed shall be free from acute changes.

.4 Include percentage of crushed coarse aggregate particles in granular base reports.

.5 Certification that the physical properties of the aggregates meet the requirements of this section.

.6 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.

.2 At least two (2) weeks prior to contemplated change in source of aggregates, provide written notification to the Departmental Representative and provide new materials certification in accordance with the requirements of this section.

.3 Preliminary review of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. Rejected material will not be paid for. The Departmental Representative has the right to request additional testing if there are any concerns with the proposed aggregate.

## 1.5 QUALITY ASSURANCE

.1 In accordance with section 01 43 00 - Quality Control

# PART 2. PRODUCTS

## 2.1 CRUSHED AGGREGATE

.1 Aggregates: Crushed stone shall consist of inert materials that are clean, hard, durable, with stone free from surface coatings and deleterious materials.

.2 Minimum R-value of 70 as determined by ASTM D 2488 Methodology (R-value is a measure of wear resistance).

**2.2 GRADATIONS:**

.1 Gradation shall meet the gradation below or approved equal as approved by Departmental Representative.

| Sieve Size (mm) | Percent Passing By Weight |
|---|---|
| 20 | 100 |
| 12.7 | 100 |
| 4.75 | 46 - 66 |
| 0.42 | 8 - 24 |
| 0.07 | 5 - 10 |

.2 % Fracture 75 min.

.3 Sand Equivalent 40 min.

## PART 3. EXECUTION

**3.1 EQUIPMENT**

.1 Equipment shall be capable of performing the Work as described in this Specification. Equipment that is inadequate to obtain the results specified shall be replaced or supplemented as required to meet the requirements of this Specification. Any equipment that is used in an improper manner may be cause for rejection of the Work if in the opinion of Departmental Representative the Work fails to meet the requirements of this Specification.

.2 Equipment used for compaction shall be the rolling type, vibratory type, or combination of both types, and shall be of sufficient capacity to meet the compaction requirements herein.

**3.2 LAYOUT OF WORK**

.1 The Contractor shall stake or otherwise delineate the proposed alignment of the path according to the drawings. Obtain approval of the Departmental Representative prior to proceeding with excavation and subgrade preparation.

.2 Keep people, bicycles, and other vehicles away from the compacted surface until it dries to a stable moisture content.

.3 Cut/fill bench for the surfacing crushed stone as shown on the drawings.

.4 Cut existing grade to a minimum of 100mm deep or as shown on the drawings within limits of paving. Wet and roll subgrade to obtain a firm, uniform, compacted subgrade. Keep cut sides vertical and true to line horizontally with a uniform width.

**3.3 GEOTEXTILE FABRIC**

.1 Place geotextile over prepared soft areas, overlapping ends and edges at least 300mm.

**3.4 ROOT BARRIER**

.1 To protect pathway sections in the vicinity of aggressive rooting species, install root barriers along sections of pathways, paved and gravelled roads as directed by Departmental Representative.

.2 Horizontal and Vertical root barrier shall be 40 mil HDPE with minimum 500 mm embedment.

.3 Horizontal barrier shall lay 100 mm below the gravelled surface.

## 3.5 SUBGRADE PREPARATION

.1 Prepare subgrade to a minimum depth of 150 mm as specified in Section 32 00 01.

## 3.6 PLACEMENT AND COMPACTION

.1 The Contractor is responsible for controlling placement of the material; no additional compensation will be made for material placed in excess of the specified thickness or width.

.2 Do not install crushed stone surfacing material during wet conditions (rain or snow).

.3 Do not install crushed stone surfacing material on subgrade with standing water.

.4 If the compacted depth of the crushed stone surfacing material exceeds 150 mm, place in two or more lifts of approximately equal thickness.

.5 Add or remove water to within ±2% of optimum moisture content.

.6 Use roller or mechanical hand tamper and compact to 95% Standard Proctor Maximum Dry Density (ASTM D698).

.7 Use plate tamper on edges and inaccessible areas.

.8 Loose material shall not exist on finished surface.

.9 Top of path shall be flush with adjacent grade. Remove any excess gravel on edges.

.10 Ensure there are no low or high areas, or standing water on or adjacent to path.

## 3.7 SURFACE FINISHING

.1 Use a smooth steel wheel roller for the final rolling of top surface.

.2 Water surface and evenly spread loose stones before final rolling.

.3 Make minimum of two complete passes over area to embed stones. Correct soft spots developed during rolling.

.4 Compacted surface shall be smooth and free from waves and other irregularities.

.5 Unsatisfactory portions of base course shall be removed, reworked, re-laid, and compacted at no additional expense to Parks Canada Agency.

## 3.8 INSPECTION

.1 Finished surface shall be uniform and solid.

.2 Compacted material shall be firm to the full depth of structure with no soft areas.

.3 Loose material shall not be present on the surface

.4 No ruts shall be visible on the surface.

.5 Sections that do not meet this specification, shall be repaired or replaced at the Contractor's expense

## 3.9 REPAIRS

.1 Excavate damaged area to depth of surfacing crushed stone paving material and square off sidewalls.

.2 If area is dry, moisten damaged portion lightly and scarify.

.3 Apply surfacing crushed stone to excavated area to finished grade.

.4 Compact with a 200mm to 250mm hand tamp or 1000 lb. roller.

.5 Repaired surface shall be smooth and free from waves and other irregularities. Unsatisfactory portions of base course or surface course shall be torn up, reworked, re-laid, and rerolled at no additional expense to Parks Canada Agency.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 RELATED SECTIONS

.1 Section 31 23 13 - Earthworks and Grading.

.2 Section 01 35 43 - Environmental Procedures

### 1.2 MEASUREMENT OF PAYMENT

.1 No separate payment will be made for the measures needed for dust control including supply and application of water.

## PART 2. PRODUCTS

### 2.1 NOT USED.

## PART 3. EXECUTION

### 3.1 EXECUTION APPLICATION.

.1 Apply water with distributors equipped with means of shut-off and with spray system to ensure uniform application.

.2 Request permission prior to application of water for dust control.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Inform Departmental Representative of proposed source of materials and provide access for sampling at least 2 weeks prior to commencing work.

.3 If materials have been tested by accredited testing within previous 2 months and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

## PART 2. PRODUCTS

### 2.1 MATERIALS

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

.2 Granular base: material to Section 31 05 16 - Aggregate Materials and following requirements:

.1 Type 1 or 2 fill.

.2 Crushed stone or gravel.

.3 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

.3 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.

.4 Fill material: to Section 31 05 16 - Aggregate Materials and following requirements:

.1 Type 1 or 2 fill.

.2 Crushed stone or gravel.

.3 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

## PART 3. EXECUTION

### 3.1 SUBGRADE PREPARATION

.1 Do subgrade preparation work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Construct embankments using excavated material free from organic matter or other objectionable materials.

.1 Dispose of surplus and unsuitable excavated material outside of the Park unless otherwise directed.

.3 Place fill in maximum 300 mm layers and compact to at least 98% of maximum dry density to ASTM D 698.

### 3.2 GRANULAR BASE

.1 Obtain Departmental Representative's approval of subgrade before placing granular base.

.2 Place granular base material to lines, widths, and depths as indicated.

.3 Compact granular base in maximum 300 mm layers to at least 100% of maximum density to ASTM D 698.

## 3.3 CONCRETE

.1 Obtain Park Canada Representative's approval of granular base prior to placing concrete.

.2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.3 Immediately after floating, give slab surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.

.4 Provide slope on concrete to provide positive drainage.

.5 Provide edging as indicated with 10 mm radius edging tool.

.6 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Departmental Representative can be demonstrated. Hand finish surfaces when directed by Departmental Representative.

.7 The concrete mix shall be designed as follows:

| | | Class A |
|---|---|---|
| .1 | Minimum 28 day compressive strength | 28 MPa |
| .2 | Slump not exceeding | 65 mm |
| .3 | Maximum aggregate size | 20 mm |
| .4 | Air entrainment | 5.5% - 8% |

.8 The concrete mix, on or after September 30 to April 30 of the following year, shall be designed as follows:

| | | Class A |
|---|---|---|
| .1 | Minimum 7 day compressive strength | 28 MPa |
| .2 | Slump not exceeding | 65 mm |
| .3 | Maximum aggregate size | 20 mm |
| .4 | Air entrainment | 5.5% - 8% |

.9 Lean Concrete (Concrete Slurry).

.1 The followings are the specifications for lean concrete:

| Aggregate Sieve Size | % Passing by Weight |
|---|---|
| 25 mm | 100 |
| 19 mm | 70 - 100 |
| 4.75 mm | 35 - 65 |
| 4.26 mm | 15 - 30 |
| 75 mm | 0 - 15 |

| | |
|---|---|
| Slump: | 25 mm to 85 mm |

| | |
|---|---|
| Compressive Strength: | 6 MPa to 10 MPa |
| Entrained Air: | 6% to 8% |
| Cement Content: | 150 kg/m$^3$ |
| Fly Ash: | 10% by Cement Content |
| Maximum Aggregate Size: | 20 mm |

.10 Ready mixed concrete shall be mixed and transported in accordance with ASTM C-94 and CSA Standard A.23.1.3 for Ready Mixed Concrete.

## 3.4 TOLERANCES

.1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

## 3.5 EXPANSION AND CONTRACTION JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals shown on the drawings.

.2 Install expansion joints.

.3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

## 3.6 ISOLATION JOINTS

.1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.

.2 Install joint filler in isolation joints in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.3 Seal isolation joints with sealant.

## 3.7 CURING

.1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound.

.2 Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period.

.3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

## 3.8 FINISHES

.1 Formed surfaces exposed to view: sack rubbed finish in accordance with CSA A23.1/A23.2.

.2 Pavements, walks, curbs and exposed site concrete:

.1 Screed to plane surfaces and use wood floats.

.2 Provide round edges and joint spacings using standard tools.

.3 Trowel smooth to provide lightly brushed non-slip finish.

## 3.9 TOLERANCES

.1 The finished surfaces of all concrete work shall be true to the required cross-section with a tolerance of plus or minus 6 mm from the required elevation and dimensions. Surface

of curbs, gutters or sidewalks shall not show any depressions or bumps exceeding 3 mm under a straight edge 3 m long placed parallel to the curb or sidewalk. Concrete not meeting the requirements specified shall be removed to the nearest joint and replaced at the Contractor's expense.

## 3.10 FIELD TESTS

.1 Tests shall be made of the concrete to ensure that it meets these specifications. Testing shall be done to conform to the following standard specifications:

| Test | Current Issue of ASTM |
|---|---|
| Sampling of Fresh Concrete | 1c |
| Obtaining and Testing Drilled Cored for Compressive Strength | 14c |
| Test for Slump of Concrete | 5c |
| Compression and Flexure Test | 8c |
| Compressive Strength of Moulded Concrete Cylinders | 9c |
| Measurement of Air Content | 7c |
| Making and Curing Concrete Compression and Flexural Test Specimens | 3c |

.1 Three concrete cylinders shall constitute one test and shall be made from the same batch or load. They shall be stored undisturbed on site for 24 hours, covered with a plastic sheet to prevent loss of moisture. They shall then be delivered to an approved testing laboratory, and laboratory cured with one cylinder tested at seven days and the other two at twenty-eight days. A set of three cylinders shall be taken for every 100 m3 of concrete poured, or as directed by the Departmental Representative. Test cylinders shall be 150 mm or 100 mm in diameter.

.2 When construction begins, the Departmental Representative reserves the right to request additional cylinders to be made in order to establish a concrete strength pattern as quickly as possible.

.3 The Departmental Representative shall make the cylinders and slump tests.

.2 Penalties for Insufficient Strength

.1 Where there are variations from specified design strength, the following adjustments will be made based on the 28 day, laboratory cured cylinders:

.1 When concrete strength of any set exceeds 95% of design strength, full payment for the work shall be made at the contract unit prices.

.2 When concrete strength of any set is greater than 80% but less than 95% of design strength, the price paid to the Contractor for the work represented by that set of cylinders shall be determined by the following formula:

$$P - [\frac{2P\,(A - B)}{A}]$$

Where:

P = unit price
A = specified strength
B = average 28 day cylinder strength.

.3 If concrete strength of any set is less than 80% of design strength, the work represented by that set of cylinders will be rejected.

.4 Where the average strength of all tests for the total work falls below design strength, but above 95% of design strength, that work not already having a price adjustment under the preceding clauses shall be subject to the following adjustment. The price paid by the Contractor shall be determined by the following formula:

$$P - [\frac{2\,(A - B)}{A}]$$

Where:

P = unit price
A = specified strength
B = average 28 day cylinder strength.

.3 Protection

.1 The Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of 5 days after the concrete has been finished.

## 3.11 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with material as shown on the drawings

.1 Compact and shape to required contours.

## 3.12 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.

## 3.13 CONCRETE DETERIORATION

.1 Concrete that shows surface scaling, deterioration or loss of cement or aggregate during the maintenance period will be rejected and require removal and replacement by the Contractor at no cost to Parks Canada Agency.

## 3.14 SIDEWALK, CURB AND GUTTER FAILURES

.1 Replacement of affected sections shall be required when one or more of the following exist:

.1 Any crack greater than 3 mm in width with no vertical displacement or chipping or spalling edges.

.2 Any crack with vertical displacement or chipping or spalling edges.

.3 Any longitudinal crack greater than or equal to 1.5 mm in width.

.4 A displacement at a joint of greater than or equal to 12 mm.

.5 A dished surface of sidewalk and/or gutter.

.6 A reverse crossfall or crossfall greater than 8% or less than 0.7%.

.7 A random cracking of any size.

.8 Any feature considered detrimental to pedestrian safety or appearance of the sidewalk and/or curb and gutter.

.9 A corner cut exists.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 The Contractor is responsible for all painted roadway lines and pavement messages. The enclosed specifications are related to the Work to be completed by the Contractor.

.1 The Plans show details of the general line and message painting required for the Project.

.2 The Work consists of supplying and applying pavement markings and messages as shown on the Plans and in accordance with Alberta Transportation Standard Specifications for Highway Construction, Section 7.2, "Painted Roadway Lines" and Section 7.3, "Pavement Messages", except as modified herein.

.3 All roadway lines shall include painting requirements as shown on Design Drawing T4.

### 1.2 REFERENCES

.1 Current edition of Alberta Transportation's Standard Specifications for Highway Construction.

.2 Current edition of Alberta Transportation's Highway Pavement Marking Guide.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 The Contractor shall supply all paint and glass beads in accordance with Alberta Transportation's Standard Specifications for Highway Construction, Section 5.20, Supply of Line Painting Materials.

## PART 3. EXECUTION

### 3.1 PAINTED ROADWAY LINES

.1 Painted roadway lines shall be completed in accordance with Alberta Transportation Standard Specifications for Highway Construction, Section 7.2, "Painted Roadway Lines".

### 3.2 PAVEMENT MESSAGE MARKINGS – ARROWS

.1 Urban traffic arrows are required for the pavement messages on this project and shall be in accordance with Alberta Transportation's Highway Pavement Marking Guide, Standard Drawing TCS-C-401.1 and as shown on the Drawings.

### 3.3 PAVEMENT MESSAGE MARKINGS – STOP BAR

.1 Standard stop bar markings are required for the pavement messages on this project and shall be in accordance with Alberta Transportation's Highway Pavement Marking Guide, Standard Drawing TCS-C-301 and as shown on the Drawings.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This section specifies the requirements for Site Furnishings including:

.1 Speed Bumps

.2 Parking Curbs

.3 Animal-Proof Trash/Recycle Containers

.4 Picnic Tables

.5 Campsite ID Card Signs

### 1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Ensure that surfaces and adjacent structures are ready for furniture installation prior to delivery to site. Storage on site is not desirable.

### 1.3 QUALITY ASSURANCE

.1 Submit shop drawings and other supplier specification information to the Departmental Representative for approval prior to placing order or delivery to site.

### 1.4 SITE CONDITIONS

.1 Report in writing to the Departmental Representative, prior to commencing work, any conditions or defects encountered on the site, upon which the work of this section depends, and which may adversely affect the performance of the work .

.2 Do not commence work until such conditions or defects have been investigated and corrected.

.3 Commencement of work implies acceptance of surfaces and conditions and no claim for damages or resulting extra work will be accepted except where such conditions cannot be determined prior to construction.

### 1.5 WARRANTY

.1 Warranty all work for a period commencing on the date of issue of the Construction Completion Certificate to the date of the Final Acceptance Certificate.

## PART 2. PRODUCTS

### 2.1 SPEED BUMPS

.1 Shall be Burnco Eco-Flex Rubber c/w end caps

.1 Part Number: F6536 or approved equivalent

.2 Black with reflective yellow stripes

.3 1.8m (6’) length, 0.3m (1’) wide, 57mm (2-¼”) thick

.2 Fastening of speed bumps to surfaces shall conform to the Manufacturer’s recommendations and must be fastened in a manner which allows for annual removal.

### 2.2 PARKING CURBS

.1 Shall be Westcon Precast Inc. concrete curb or approved equivalent

.2 Size: 178 mm x 2,130 mm

.3 Requires two 400 mm minimum length anchor pins

.4 Installation as per Manufacturer's recommendations at locations as shown on drawings

**2.3 ANIMAL-PROOF TRASH / RECYCLING CONTAINERS**

.1 Trash and recycle containers shall be provided to Contractor by Parks Canada Agency.

.2 Contractor to install containers on concrete pads as per manufacture's recommendations and in locations as shown on design drawings.

**2.4 PICNIC TABLES**

.1 All existing picnic tables, located in each campsite and picnic area affected by the new Work, shall be stockpiled at Red Rock SMS area or an alternate location approved by Departmental Representative, and replaced on the new concrete pad locations upon completion of the surface works and prior to the campground opening for public use.

.2 Contractor shall supply, deliver and place any new picnic tables required for additional sites constructed as part of this Contract. All camp sites and tent sites require a picnic table. New tables shall closely match existing models

.3 Contractor shall submit shop drawing of new picnic tables to Departmental Representative for approval prior to procurement.

.4 Contractor shall take adequate measures to ensure picnic tables are not damaged during removal, storage and replacement operations. Any damage incurred must be repaired to the satisfaction of the Departmental Representative.

**2.5 EXISTING SIGNAGE (TRAFFIC, CAMPSITE ID AND GROUPING CARD SIGNS)**

.1 Existing traffic, campsite ID card and grouping card signs shall be removed and provided to the Departmental Representative.

.2 New traffic signs shall be in accordance with this Contract and construction drawings.

.3 New camp site ID and grouping cards are required for all sites and directional signage locations. New signs shall closely match existing sign material and design.

.4 Contractor shall submit shop drawing of new signage to Departmental Representative for approval prior to procurement.

.5 Camp site ID cards shall be mounted on electrical pedestals where available, or sign post or barrier rail for non-electrified sites. Consult with Departmental Representative prior to mounting signs.

**2.6 BARRIER RAIL AND POST & RAIL FENCES**

.1 Barrier rails shall be used at all back-in campsite trailer parking stalls.

.2 Post & Rail Fence shall be used at locations as identified on the drawings and in the field by Departmental Representative.

**PART 3. EXECUTION**

**3.1 NOT USED**

**END OF SECTION**

## PART 1. GENERAL

### 1.1 MEASUREMENT PROCEDURES

.1 Preparation of sub-grade for placing of topsoil will not be measured for payment.

.2 Topsoil Placement and grading will be measured in square metres.

.3 Imported Topsoil will be measured in cubic metres.

## PART 2. PRODUCTS

### 2.1 DEFINITIONS

.1 Weeds: Includes, but not limited to, dandelions, jimsonweed, quackgrass, horsetail, morning glory, rush grass, mustard, lambsquarter, chickweed, crabgrass, Canada thistle, tansy, ragwort, bermuda grass bindweed, bent grass, perennial sorrel, brome grass, red root, pigweed, buckweed, scentless chamomile, toadflax, foxtail, kochia, and perennial sow thistle.

### 2.2 EXAMINATION

.1 Report to the Departmental Representative, in writing, of any conditions or defects encountered on the site during or before construction on which work on this section depends and which may adversely affect its performance.

.2 Do not commence work until such conditions have been investigated and corrected.

.3 Commencement of work shall imply acceptance of surface and conditions and no claim for damages and extras resulting from such conditions or defects will be accepted thereafter, except in cases where such conditions cannot be known prior to construction.

### 2.3 ANALYSIS

.1 The Contractor shall submit representative samples of the topsoil to be used for the intended project to a professional soil laboratory for analysis and recommendations. A copy of the laboratory report shall be submitted to the Departmental Representative for review and approval. Testing shall be at Contractor's expense. The Contractor shall provide proposed amendments to meet laboratory's requirements for Departmental Representative review and written approval.

.2 The soil analysis report will include the topsoil source and the recommendations for correction to meet the nutritional growing requirements of specified plant materials. Recommendations will clearly state the type and quantity of soil additives and application procedure to be used.

.3 All topsoil, whether native or imported, shall be tested and the report shall to be submitted to the Departmental Representative prior to construction. Such analysis shall be performed on representative samples from each topsoil source, including site stockpile, and shall determine nitrogen, phosphorous, potash, soluble salt content, electrical conductivity, pH value, percentage sodium adsorption ratio, and values of sand, clay, silt, and organic matter.

.1 Recommended soil composition:

.1 Sand: 35% (±2%) by dry mass

.2 Clay: 30% (±2%) by dry mass

.3 Silt: 35% (±2%) by dry mass

.4 Organic Matter: 5% - 10% by dry mass

.5 Toxic Chemicals: None

.6 Electrical Conductivity: Maximum 1.5 mmhos/cm

.7 pH Value: 6.0 to 7.5

.8 Sodium Adsorption: less than 6.

.2 Recommended values provided for Tender and Bid only. Topsoil amendments to be made per soil laboratory standards and recommendations.

.4 When the original source of topsoil for which a sample has been submitted is exhausted, topsoil from a new source shall not be used until tested and amendments approved by the Departmental Representative.

## 2.4 MATERIALS

.1 Stockpiled Topsoil: original topsoil stripped from site and stockpiled on site or in nearby location. Soil stored for longer than two (2) years shall be cleaned of all surface vegetation, shredded, spread, rototilled to a friable consistency, and amended as required.

.2 Imported Field Topsoil: where permitted by Parks Canada Agency, shall be natural, fertile, friable, agricultural loam, or amended to contain not less than six (6%) percent or more than twenty (20%) percent organic material, a pH value ranging from 5.8 to 7.3, a nutrient content approaching 55 kg/ha actual N, 80 kg/ha actual P, 230 kg/ha actual K, sulphur content of not less than 3 nor greater than 12 ppm and a Na content not less than 200 ppm and electro conductivity of 1.5 mmhos/cm or less. Soil reasonably free from subsoil, slag, clay, stone, lumps, live plants, roots, sticks, weeds, and foreign matter. Soil free of all toxic substances.

.3 Organic matter: shall be composted manure, completely decomposed, from friable animal litter free from clay, stone, lumps, live plants, roots, sticks, straw, quack-grass, weeds, field crop seed, and foreign matter, having a pH of 5.8 - 7.3 and conductivity less than 0.5 mmhos/cm. Do not use peat.

.4 Other soil amendment materials to meet soil laboratory recommendations.

.5 Recommended values for materials provided for Tender and Bid only. Topsoil amendments to be made per soil laboratory standards and recommendations.

.6 Imported materials to be from sources approved by Parks Canada Agency. Departmental Representative may reject any material source.

## 2.5 SUBMITTALS

.1 Contractor to provide to Departmental Representative prior to delivery of soil materials (topsoil and amendments) to site for review:

.1 Test results from analysis.

# PART 3. EXECUTION

## 3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

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

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

## 3.2 STRIPPING OF TOPSOIL

.1 Mow areas to be stripped within 25 mm height. Dispose of mowed vegetation in approved location.

.2 Strip topsoil to full depth of topsoil (150 mm for tender purposes) in areas as indicated and remove to stockpile location approved by the Departmental Representative.

.3 Do not mix topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.4 Stockpile height not to exceed 2 m.

.5 Protect stockpiles from contamination and compaction.

.6 Stripped sod shall be broken into 50mm or smaller pieces and mixed with the topsoil.

.7 Screen topsoil to remove stones, branches, roots, or debris 50mm and larger.

.8 If required, the contractor shall import topsoil to mix with stockpiled salvaged topsoil at a ratio of 1:2. The supplier source of the imported topsoil must be approved by the Departmental Representative prior to import into the Campground site.

## 3.3 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 which protrudes more than 75 mm above surface..

.3 Dispose of removed material off site.

## 3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Only place topsoil if seeding or sodding can immediately follow in the same season.

.2 Place topsoil after Departmental Representative has accepted subgrade.

.3 Replace topsoil to all stripped areas immediately following fine grading.

.4 Use topsoil stripped from site, then other topsoil stockpiled on site. Do not use imported topsoil unless all topsoil material is used from within the compound. The need for, and the source of imported topsoil shall be approved by Departmental Representative.

.5 Amend topsoil per laboratory recommendations as approved. Mix stockpiled topsoil and imported topsoil as approved to satisfaction of the Departmental Representative.

.6 Spread topsoil in uniform layers not exceeding 100 mm.

.7 For sodded areas keep topsoil 15 mm below finished grade.

.8 Spread topsoil to following minimum depths after settlement.

.1 100 mm for seeded areas.

.2 100 mm for sodded areas.

.3 300 mm for planting beds.

.9 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

.10 Do not place topsoil when either topsoil or subgrade is frozen, excessively wet or dry, or in a condition inhibiting proper grading, cultivation, or compaction.

.11 Cultivate topsoil to a depth of 75mm, breaking down lumps. Remove stones larger than 50mm, weeds, roots, and other foreign matter.

.12 Do not compact topsoil.

## 3.5 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.

.1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.

.1 Leave surfaces smooth, uniform and firm against deep footprinting.

## 3.6 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 Dispose of materials except topsoil not required outside of the Campground at an approved recycling or dumping facility.

## 3.8 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

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

**END OF SECTION**

## PART 1. GENERAL

### 1.1 GENERAL

.1 This specification covers preparation of the area to be seeded, the supply and application of seed, and the finishing of seeded areas.

.2 Areas to be seeded shall include any exposed earth surfaces due to construction . Any disturbed areas outside of theses limits will be seeded at the Contractor's expense.

## PART 2. PRODUCTS

### 2.1 SUPPLY OF MATERIALS

.1 Materials for seeding, including seed, mulch and water shall be supplied by the Contractor.

.2 Seed materials shall be stored dry and protected from direct sunlight and other detrimental conditions. Materials that have been subjected to detrimental conditions, as determined by Departmental Representative, may not be accepted for use on the project.

.3 Seed shall be mixed and tested by a recognized seed house and clearly marked with the name of the supplier and the specified seed composition. The Contractor shall supply the consultant with the certificates of analysis for all of the lots of seed used, a minimum of 14 days prior to seeding. Contractor is responsible for ensuring that seed is viable.

.4 Store seed in the original containers, tagged with identification as to the analysis of the seed mixture, percentages of seed, year of production, net weight, date when tagged, and name and address of supplier.

.5 Deliver seed to the site only when ready for seeding.

.6 Provide original tag or bag label that lists seed, seed mix percentages by weight, and supplier name and address for review and approval by Departmental Representative prior to ordering seed. Provide sample of seed to Departmental Representative for review and approval, if required.

.7 Provide sample of mulch to be used in hydro-mulch operations. Identify supplier or manufacturer of the mulch for review and approval prior to construction.

### 2.2 GRASS SEED

**.1** Contractor to provide anticipated quantity of seed to Parks Canada Agency upon contract award.

.2 Grass seed to consist of:

.1 40% Creeping Red Fescue

.2 20% Perennial Ryegrass

.3 40% Kentucky Bluegrass

### 2.3 HYDRO-MULCH

.1 Mulch material shall be Flexterra High Performance-Flexible Growth Medium or approved equal. Mulch shall be clean and free of weeds and other foreign matter. Mulch shall be 100% biodegradable, compatible with the environment, and shall contain no germination-inhibiting components.

## 2.4 TACKIFIER

.1 The binder must be capable of joining together the mulch particles to secure the mulch to the ground. The binder shall not form an impervious seal that will prevent the penetration of moisture to underlying soil.

.2 Contractor to provide Departmental Representative with description of durability of tackifier and supplier for review and approval prior to construction.

## 2.5 WATER

.1 Water supplied by the Contractor shall be free of any impurities that might inhibit germination of the seed.

## 2.6 APPLICATION RATE

.1 Broadcast seeding rate is 50 kg/ha (e.g., 1x50 kg bag will cover 1 hectare). The minimum application for Hydro-Seeding is 75-100 kg/ha

# PART 3. EXECUTION

## 3.1 NOTIFICATION OF COMMENCEMENT OF WORK

.1 The Contractor shall notify the Departmental Representative a minimum of 48 hours prior to any seeding work. Seeding operations shall not commence until all areas designated for seeding have been prepared to the satisfaction of the Parks Canada Agency Representative.

.2 Seeding operations shall not commence until the Departmental Representative has reviewed the Certificate of Seed Analysis and verified the specified seed mixture supplied.

## 3.2 SURFACE PREPARATION

.1 Grading or topsoil placement shall be completed to the satisfaction of the Departmental Representative prior to any surface preparation. Only place topsoil if seeding (or sodding) can immediately follow in the same season.

.2 All eroded areas shall be corrected prior to surface preparation, as determined by the Departmental Representative.

.3 Areas to be seeded shall be finished to a smooth and uniform surface, which is to a depth of not less than 25 mm at the time of seeding. Where necessary, the surface loosened shall be scarified and the Contractor shall dispose of stones and other debris as determined by the Departmental Representative.

.4 Seeding will not be permitted on hardened, crusted, saturated, frozen or rutted soil.

## 3.3 WEATHER CONDITIONS

.1 The Contractor shall not proceed with the Work when, in the opinion of the Departmental Representative, weather conditions are unsuitable. The Departmental Representative will not allow work to proceed when wind conditions are such that material is being carried beyond the designated work areas or that the material is not being uniformly applied.

## 3.4 PROTECTION

.1 The Contractor shall take reasonable care to prevent the contamination of structures, signs, guardrails, fences, utilities and other installations by his operations. Where such

contamination occurs, the Contractor shall remove the offending material using methods acceptable to the Departmental Representative.

.2 The Contractor shall ensure that hydro-seeding does not dislodge soil or cause erosion.

.3 The Contractor shall be responsible for the protection of the Work and shall, at Contractor's own expense, repair all areas damaged by any cause, until the Work has been accepted by the Departmental Representative.

## 3.5 SEEDING OPERATIONS

.1 Seeding may be broadcast seeding or hydro seeding.

.2 Grass seeding is most effective if seeded in the fall, this allows for full scarification of the seed over the winter and adequate moisture available. Seed in the fall until immediately before freeze-up so that seeded areas will germinate in the spring.

.3 Broadcast Seeding

.1 All broadcast seeding is to occur during calm weather (winds less than 10km/hr).

.2 Sow seed uniformly. Use half of required amount of seed in one direction and remainder at right angles.

.3 Rake the seed into the soil. Do not allow seed to be seeded deeper than 10mm (or it may not germinate).

.4 Roller pack the site immediately after broadcast seeding.

.5 Water immediately with a fine spray, avoiding washing out the seed. Apply enough water to ensure penetration of 50mm. When fall seeding do not water seed bed.

.6 Protect seeded areas against damage. Remove this protection after grass areas have been accepted by the Departmental Representative.

.7 Reseed at two week intervals where germination has failed. Do not reseed after mid-May (wait until the fall).

.8 Apply hydro-mulch as a cover immediately after seeding to protect the seed.

.9 Ensure that water will penetrate the hydro mulched areas.

.4 Hydro seeding

.1 Mix seed, water, tackifier, and mulch in a slurry

.2 Apply slurry during calm weather (winds less than 10km/hr).

.3 Apply slurry uniformly. Ensure good contact between slurry and topsoil.

.4 Ensure that water will penetrate the hydro seeded areas.

## 3.6 RESEEDING

.1 At locations that fail to show a uniform stand of grass for any reason during the calendar year following the year of initial seeding, the Contractor shall repair the defective locations as determined by the Departmental Representative. A uniform stand of grass will be considered growth that shows no deterioration or bare spots greater than 1 square metre in size, and provides a minimum of 80 percent ground cover as determined by the Departmental Representative.

.2 The initial inspection of seeding will occur during the month of May of the calendar year following the year of initial seeding. The Contractor shall complete any required reseeding work prior to June 15 of that year. This date will be extended if, in the opinion of the Departmental Representative, the weather conditions prior to June 15 are not suitable for reseeding work.

.3 The Contractor shall supply all materials necessary for reseeding work and complete all reseeding work entirely at Contractor's own expense.

## 3.7 SUBSTANTIAL PERFORMANCE

.1 Seeded areas will be considered by the Departmental Representative to be substantially performed provided that seeded areas are properly established, free of eroded, bare, or dead spots, and 98% free of weeds.

.2 "Bare" will be determined by a count of plants. Density of native seedlings must be greater than 60 seedlings per sq. metre eight weeks after seeding. Plants will be counted in a sample area with the lowest germination.

.3 Areas seeded in fall will be accepted in following spring, two months after start of growing season

**END OF SECTION**

## PART 1. 1.0 GENERAL

### 1.1 DESCRIPTION

.1 Areas to be sodded shall be as indicated on the landscape plans which accompany the specifications and as directed onsite by the Departmental Representative. The Contractor shall furnish all labour, materials, equipment, and services necessary to complete the work as specified herein and as shown on the drawings.

### 1.2 RELATED WORK

.1 32 91 19 – Topsoil Placement and Grading

.2 32 92 19 - Seeding

### 1.3 QUALITY ASSURANCE

.1 The Contractor must have experience at performing this type and scale of work and be willing to provide proof of this experience.

### 1.4 DELIVERY AND STORAGE

.1 Sod is to be cut by approved methods in accordance with recommendations of the CNTA.

.2 Roll or fold sod prior to lifting, in such a manner as to prevent tearing or breaking.

.3 Deliver sod to site within 24 hours of being lifted and lay sod within 36 hours of being lifted.

.4 During dry weather protect sod from drying and water sod as necessary to ensure its vitality and prevent the dropping of soil during handling. Dry sod will be rejected.

.5 Deliver fertilizer in waterproof bags showing weight, chemical analysis and name of manufacturer. Store in weatherproof building to prevent loss of effectiveness.

### 1.5 INSPECTION

.1 Make all materials available for inspection, upon arrival on the site, or at source of supply when requested.

.2 Submit name of sod supplier.

.3 Give Departmental Representative 48 hours notice when materials are available for inspection.

.4 Obtain approval by Departmental Representative of finished topsoil surface before sodding.

.5 Departmental Representative reserves the right to reject sod, after it has been installed, if sod does not conform to the specifications and/or drawings.

.6 Remove all rejected materials immediately from the site.

.7 Notify Departmental Representative as soon as sodding has been completed. All sodding work is to be inspected upon completion.

### 1.6 MAINTENANCE AND ACCEPTANCE

.1 Maintain sodded areas from the time of installation to expiration of the maintenance period according to the following schedule:

.1 Mowing at regular intervals to maintain height of between 40 and 60 mm. Do not cut more than 1/3 of the grass height at any one mowing. Trim and clip edges.

.2 Water sodded areas in sufficient quantities and at required frequency to maintain sub-soil immediately under sod continuously moist for a depth of 100 mm.

.3 Control weeds when required and/or directed. Use only herbicides approved by Agriculture Canada, and only in accordance with the manufacturer's recommendations. Comply with all herbicide control regulations of locality in which operation is to be carried out. Apply only during calm weather when air temperature is above 10°C. Make good all damage resulting from the use of herbicides at no extra cost.

.4 Make good any erosion that results from faulty workmanship and/or material at no extra cost.

.5 Replace any dead, damaged, slipping, or washed out sod with new sod during the maintenance period. Proper root growth shall be the responsibility of the Contractor.

.6 Roll sodded areas where necessary, to remove depressions and irregularities.

.7 Provide adequate protection of the sodded areas against damage. Remove protection after lawn areas have been accepted.

.8 Sodded areas will be accepted at final inspection provided that:

.1 Sodded areas are properly established.

.2 Sod is free of bare and dead spots and without weeds.

.3 No surface soil is visible when grass has been cut to a height of 40 mm.

.4 Sodded areas have been cut a minimum of two times.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Sod: All sod shall be Certified No. 1 grade cultivated turf grass, grown in accordance with CNTA classifications. At time of sale it must have a strong, fibrous root system and be free of stone and burned or bare spots. Sod shall be low maintenance and drought tolerant. It shall be composed of a minimum of 40% Kentucky Bluegrass (Poa pratensis) and 30% Fescue (Festuca spp). Contractor to inform in writing Departmental Representative of constituent grasses in sod for Parks Canada Agency review and approval. Field or pasture sod shall not be accepted. The sod shall not contain more than ten (10) broadleaf weeds per 45 square meters and shall be free of disease. The sod shall be of sufficient density that no surface soil will be visible when mowed to a height of 40 mm. The sod shall be cut a minimum of 25 mm in thickness and in no cases shall it exceed 40 mm in thickness. All sod supplied shall be mowed to a height of 50 mm prior to delivery.

.2 Fertilizer, if needed, shall be applied as directed by Departmental Representative. Fertilizer shall be uniform in composition, dry and free-flowing, and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizers which become caked or otherwise unsuitable for use will not be accepted.

.3 Water: shall be potable and free of minerals which may be detrimental to plant growth.

.4 Wooden Pegs: (when required) shall be 25 x 25 x 230 mm in length. Ensure pegs are long enough to securely anchor sod.

## PART 3. EXECUTION

### 3.1 PREPARATION

.1 Contractor is responsible for checking the locations of all underground services, and is responsible for any damages his actions occur.

.2 Contractor is responsible for topsoil analysis per Section 32 91 19.

.3 Fine grade subgrade, eliminating uneven areas and low spots.

.4 Legally dispose from property all foreign materials, undesirable plants and their roots, stones and debris. Do not bury foreign material beneath areas to be sodded.

.5 Legally dispose of subsoil that has been contaminated with oil or gasoline.

.6 Where requested by Parks Canada Agency Representative, apply fertilizer at the following rates:

.1 during the final grading operation, and directly before sodding, apply 11-48-0 at 400 kg/ha (.04kg/m2) The fertilizer shall be evenly spread and incorporated into the top 50 mm of topsoil.

.2 the following spring, after threat of frost is past, apply 16-20-0 at 300 kg/ha (.03kg/m2). The fertilizer to be spread evenly.

.7 The above rates are subject to adjustment upon receipt of a topsoil analysis report. Exact formulation ratio and application rates to be as approved by Parks Canada Agency Representative.

### 3.2 INSTALLATION

.1 Sod shall be laid with tight butt joints. Do not leave any open joints or overlap adjacent pieces of sod. Ensure that adjacent rows are laid in a staggered sequence.

.2 Ensure finished sod surface is flush with adjoining grass areas, and slightly below (12-25 mm) pavement or top surface of curbs.

.3 On slopes steeper than 4:1 lay sod across the face of the slope and peg each row at intervals of not more than 600 mm. Drive pegs flush with surface of sod.

.4 In swales, lay sod perpendicular to direction of swale, unless otherwise noted on drawings.

.5 A full row of sod not less than 450 mm in width shall be laid along the perimeter of the sodded area, parallel to the planted areas or walkways. The sod shall be edged to form neat openings at the base of trees and the edge of shrub bed areas.

.6 Immediately after installation of sod, water area with sufficient amounts to saturate sod and underlying topsoil to a minimum depth of 100 mm.

.7 After sod and soil have dried sufficiently to prevent damage, roll area with equipment as approved by Departmental Representative to ensure good bond between sod and soil and to remove minor irregularities. Clean up and remove from site all waste and extra sod at the end of each day or as directed.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 For every one tree removed, three (3) tree plantings in kind will be planted.

### 1.2 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging / nursery wrapping, labelled with manufacturer's name and address.

.1 Protect plant material from frost, excessive heat, wind and sun during delivery.

.2 Protect plant material from damage during transportation:

.1 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 Delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical. Vehicle to be refrigerated in the event of hot weather.

.3 Storage and Handling Requirements:

.1 Immediately store and protect plant material which will not be installed within 1 hour in accordance with supplier's written recommendations and after arrival at site in storage location approved by Departmental Representative.

.2 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 topsoil and watering to full depth of root zone.

.2 For pots and containers, maintain moisture level in containers until installation.

.3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones until installation.

.3 Store and manage hazardous materials in accordance with manufacturer's written instructions.

### 1.3 WARRANTY

.1 Contractor hereby warrants that plant material will remain free of defects, but for one full growing season.

.2 End-of-warranty inspection will be conducted by Departmental Representative.

.3 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 Plant material including trees and shrubs shall be provided as specified by the Departmental Representative.

.1 Trees and shrubs shall be species not cultivars (except Acer negundo ‘Baron’).

.2 Coniferous trees shall be a minimum of 2.5m height; deciduous trees shall be a minimum of 40mm caliper.

.3 Requests for substitutions, whether for different size, species, or other reason, shall be made in writing by the Contractor to the Departmental Representative. No substitutions shall be permitted unless approved by Departmental Representative in writing. The Contractor shall allow at least ten (10) days for such requests to be processed by the Departmental Representative.

.2 Type of root preparation, sizing, grading and quality: comply to *Canadian Standards for Nursery Stock*, latest edition.

.3 Plant material: free of disease, insects, insect or rodent damage, sunscald, hail damage, cankers, frost cracks, or other defects or injuries and structurally sound with strong fibrous root system. All parts of the plant material shall be moist and show live, green cambium tissue when cut.

.4 Trees: with straight trunks, well and characteristically branched for species. Conifers shall show branching within 400mm of root crown. Deciduous trees shall show branching within 1/3 of the total height of the tree. Trees shall have a well-balanced crown and no weak crotches.

.5 Trees shall have one sturdy, reasonably straight, vertical, and well-developed leader, where this is characteristic of the species.

.6 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

.7 Collected stock: maximum 40 mm in caliper, with well-developed crowns and characteristically branched; no more than 60% of overall height may be free of branches.

.1 During collection, ensure 10% maximum seed crop (or plants) are collected from healthy population of many individuals, and from several plants of same species.

.2 Leave remainder for natural dispersal and as food for dependent organisms.

.8 Plant material brought in from other provinces or states must be approved in writing by Departmental Representative prior to delivery and inspected and approved by Departmental Representative prior to installation.

.9 Branches shall be carefully bound in such a way as to prevent damage, breakage, or bruising during transportation. Plants with broken or abraded trunks or branches or which are badly desiccated may be rejected.

.10 Plant material that has been sheared or pruned to produce an untypical shape, height and stem diameter, or shoot density may be rejected.

.11 Plant material may be rejected when the ball of earth surrounding the roots has been cracked or broken preparatory to or during the process of planting, or when the burlap, staves, and ropes, required in connection with their shipping or transplanting, have been removed.

.12 Plant material shall be subject to inspections for conformity to specification requirements and approval by Departmental Representative at their place of growth and/or upon delivery. Such inspection and approval does not relieve the Contractor of Contractor's responsibilities under this contract.

.13 Plant material supplied by the Contractor and rejected by Departmental Representative shall be replaced with acceptable plant material at the Contractor's sole expense.

.14 Contractor to provide plant material list from nursery of origin (i.e., where the trees or shrubs were grown) identifying species and quantity to be supplied for project to Departmental Representative for review and written approval in advance of delivery.

.15 Contractor to provide plant material invoice or bill of sale from nursery of origin identifying species and quantity supplied for project to Departmental Representative for review and approval prior to installation.

**2.2 WATER**

.1 Free of impurities that would inhibit plant growth.

**2.3 MULCH**

.1 Deciduous / coniferous wood mulch shall consist of maple, poplar, birch, pine, spruce, douglas-fir chipped wood or bark or other wood material subject to review and approval by Departmental Representative. Do not use ash or elm.

.2 Chip size shall be minimum 50 mm.

.3 Mulch shall be free of non-organic material, wood preservatives, paint, nails, screws, or other metal, and rotting or diseased wood. Mulch shall be free of soil, sawdust, or peat moss (no more than 5% by dry weight). Mulch may be recycled wood. Mulch may be chipped wood and branches from tree cutting on site.

.4 Provide sample to Departmental Representative for review and approval prior to construction.

**2.4 STAKES**

.1 Wood or metal t-bar, pointed one end, 38 x 38 x 2300 mm

**2.5 GUYING COLLAR**

.1 Tube: plastic, 13 mm diameter, nylon reinforced.

**2.6 TRUNK PROTECTION**

.1 Trunk protection may be wire mesh or plastic strip.

.2 Wire mesh: galvanized, electrically welded 1.4 mm wire with 25 x 25 mm mesh and fastener.

.3 Plastic: perforated spiralled strip.

**2.7 TREE PROTECTION**

.1 Wildlife

.1 Wildlife fencing to protect new trees and shrubs, and seeding or sodding as determined by Departmental Representative.

.2 Fencing to meet ASTM A116 and be hot dipped galvanized.

.3 Acceptable product includes ToughStrand Fixed Knot Game & Cattle Fence, style 1775-6-330 or equivalent.

.4 Install post staking and guying as required.

.2 Construction

.1 Construction fencing to protect existing-to-remain trees within and adjacent to limits of work.

.2 Page wire fence 1.8 to 2.1 m high c/w post staking and guying

.3 Trunk protection

**2.8 FERTILIZER**

.1 Not used

**PART 3. EXECUTION**

**3.1 EXAMINATION**

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for planting 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.

**3.2 PLANTING PERIODS**

.1 Installation of plant material must be done May 1 through Victoria Day and Labour Day through October 15.

.2 Install “Advanced Test Planting” in the Fall of 2017 in the locations shown on the drawings.

**3.3 PRE-PLANTING PREPARATION**

.1 Proceed only after receipt of written acceptability of plant material from Departmental Representative.

.2 Remove damaged roots and branches from plant material.

.3 Locate and protect utility lines.

**3.4 EXCAVATION AND PREPARATION OF PLANTING BEDS**

.1 For individual planting holes:

.1 Stake out location and obtain approval from Departmental Representative prior to excavating.

.2 Excavate to depth and width as indicated.

.3 Do not bury removed wrapping, wire, rope, or other material in tree pit.

.4 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.

.5 Scarify sides of planting hole.

.6 Remove water which enters excavations prior to planting. Notify Departmental Representative if water source is ground water.

.7 Place erosion and sediment control matting.

## 3.5 PLANTING

.1 For bare root stock, place 50 mm backfill soil in bottom of hole.

.1 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.

.1 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.

.1 Orient plant material to give best appearance in relation to structures, roads and walks, or views of the planting location.

.5 For trees and shrubs:

.1 Backfill soil in 150 mm lifts.

.1 Tamp each lift to eliminate air pockets.

.2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.

.3 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 Mulch trees and shrubs with 100mm depth mulch.

.8 Water plant material thoroughly.

.9 After soil settlement has occurred, fill with soil to finish grade.

.10 Do not dispose of plant wrapping in tree or shrub pit.

## 3.6 TREE AND SHRUB PROTECTION

.1 Install trunk protection on deciduous trees as indicated.

.2 Install tree protection around all trees and shrubs immediately after planting to prevent animal damage, per drawings.

.3 It is advisable to screen young plants from wind over the winter.

## 3.7 TREE SUPPORTS

.1 Install tree supports as indicated.

.2 Use single stake tree support for deciduous trees less than 3 m in height and evergreens less than 2 m in height.

.1 Place stake on prevailing wind side and 150 mm minimum from trunk.

.2 Drive stake 150 mm minimum into undisturbed soil beneath roots.

.3 Ensure stake is secure, vertical and unsplit.

.4 Install 150 mm long guying collar 1500 mm above grade.

.5 Thread Type 1 guying wire through guying collar tube.

.6 Twist wire to form collar and secure firmly to stake. Cut off excess wire.

.3 After tree supports have been installed, remove broken branches with clean, sharp tools.

## 3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 One-year maintenance and warranty period to start once the warranty letter is signed by all parties for each of the two Stages.

.2 Immediately following plant material installation, any dead, broken, damaged, diseased, weak crotches, or interfering branches that have not caused the plant material's rejection shall be pruned. Pruning shall preserve the natural character or form of the plant material. Pruning tools shall be sharp and clean.

.3 Perform the 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 Keep tree protection and guy wires in proper repair and adjustment.

.3 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

## 3.9 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of substantial completion 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 Remove dead, broken or hazardous branches from plant material.

.3 Keep tree protection and tree supports in proper repair and adjustment.

.4 Remove tree protection, tree supports and level watering saucers at end of warranty period.

.5 Remove and replace dead plants and plants not in healthy growing condition.

.6 Make replacements in same manner as specified for original plantings.

.7 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.

## 3.10 SUBSTANTIAL PERFORMANCE

.1 Warranty period for trees and shrubs is one (1) year from substantial completion.

.2 Trees and shrubs shall be reviewed immediately after initial planting and during the growing season by the Departmental Representative.

.3 Final inspection of plants installed will be made by the Departmental Representative prior to the end of the Warranty Period.

.4 At the time of final inspection, all installed plant material shall be alive and in a healthy, satisfactory growing condition. Any deficiency in this respect shall be remedied at the Contractor’s own expense.

.5 Deficiencies may include: dead plants, an unhealthy or unsightly condition, and/or has lost its natural shape due to dead branches, excessive pruning, inadequate or improper maintenance,

.6 A warranty period of one (1) year will apply to replacement trees from date of their installation.

.7 Where dead trees are identified, the dead material shall be removed within four (4) weeks of notification. When necessary, approved soil and grass seed shall be added to the pit to reclaim the site and eliminate potential tripping hazards at the time of removal.

## 3.11 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

.1 Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

## 3.12 CLOSEOUT ACTIVITIES

.1 Submit maintenance reports for trees, shrubs, and other plantings.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 DESCRIPTION

.1 This Section specifies requirements for supply and installation of manholes and sewer appurtenances.

### 1.2 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Cast-in-place concrete:

.1 In accordance with Section 03 30 00.01

.2 Portland cement to CAN/CSA-A5, Type HS.

.3 Concrete mix design to produce 25 MPa minimum compressive strength at 28 days and containing 25 mm maximum size coarse aggregate, with water/cement ratio to CSA-A23.1.

.4 Air entrainment to CSA-A23.1.

.5 Additives: Fly ash to CAN/CSA-A23.5.

.2 Concrete reinforcement as indicated in drawings.

.3 Precast manhole units: to ASTM C478M, circular. Top sections flat slab top type with opening offset for vertical ladder installation.

.4 Precast catch basin sections: to ASTM C478M.

.5 Joints as follows:

.1 Sanitary manhole shall have all joints made watertight utilizing rubber gaskets conforming to the requirements of CSA-A257.3 and ASTM C443, preformed bituminous gasket (Rub-R-Nec) or other approved sealant.

.6 Mortar:

.1 Aggregate: to CAN3 – A82.56

.2 Masonry Cement: to CAN/CSA-A3000-A8, sulphate resistant, Type HS.

.7 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164. Rungs to be safety pattern drop step type.

.8 Adjusting rings: to ASTM C478M.

.9 Concrete Brick: to CAN3-A165 Series.

.10 Drop manhole pipe: to be same as sewer pipe.

.11 Frames, gratings, covers to dimensions as indicated in drawings and the following requirements:

.1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.

.2 Gray iron castings: to ASTM A48, Class 20.

.12 Castings: sand blasted or cleaned and ground to eliminate surface imperfections and coated with two applications of asphalt varnish.

.13 Granular bedding and backfill in accordance with Section 31 05 16.

.14 Concrete mixes and materials: in accordance with Section 03 30 00.01.

## PART 3. EXECUTION

### 3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33.01.

.2 Obtain approval of Departmental Representative before installing manholes.

### 3.2 CONCRETE WORK

.1 Do concrete work in accordance with Section 03 30 00.01.

.2 Place concrete reinforcement in accordance with Section 03 20 10.

.3 Position metal inserts in accordance with dimensions and details as indicated.

### 3.3 INSTALLATION

.1 Construct units in accordance with details indicated in drawings, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.

.3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.

.4 Cast bottom slabs directly on undisturbed ground.

.5 Set precast concrete base on a minimum of 150 mm granular bedding to depth compacted to 98% Standard Proctor.

.6 Precast units:

.1 Set bottom section of precast units in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight for sanitary manholes with approved rubber ring gaskets or bituminous compound or combination thereof.

.2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.3 Plug lifting holes with concrete plugs set in cement mortar or mastic compound.

.7 For sewers:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Bench to provide a smooth u-shaped channel. Side height of channel to be 0.5 times full diameter of sewer. Slope adjacent floor at 10:1. Curve channels smoothly. Slope invert to establish sewer grade.

.8 Compact granular backfill to 100% Standard Proctor.

.9 Installing units in existing systems:

.1 Where new unit is to be installed in existing run of pipe, ensure full support of existing pipe during installation. Carefully remove portion of existing pipe to dimensions required and install new unit as specified.

.2 Make joints watertight between new unit and existing pipe.

.3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this Project are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.10 Set frame and cover to required elevation on no more than three concrete rings and no more than one course of brick. Make brick joints and join brick to frame with cement mortar. Parge and make smooth and watertight using bituminous gasket.

.11 Place manhole frame and cover on top section to an elevation 5 mm below finished asphalt surface elevation or 19 mm to 25 mm below finished gravel lane surface. If adjustment required use concrete ring.

.12 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

## 3.4 ADJUSTMENT OF EXISTING UNITS

.1 As per Section 33 05 14 – Adjustment of Manholes, Hydrants and Water Valves.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 MEASUREMENT FOR PAYMENT

.1 Cost of new manholes, valves, hydrants and service boxes adjustment shall be incidental to installation unit rate. All labour and equipment necessary to adjust the appurtenance in accordance with the drawings and specifications shall be provided at no extra cost.

.2 Manholes which cannot be adequately adjusted or adjustment required is greater than 300 mm, shall be reconstructed.

## PART 2. PRODUCTS

### 2.1 GENERAL

.1 Materials used for setting and adjustment of frames shall be of good commercial quality. Use of miscellaneous random material, such as stones, wood blocks, etc., is not acceptable.

### 2.2 VALVE BOX RISERS

.1 Valve box extensions shall be 75, 100 or 150 mm cast iron conforming to ASTM A48 Class 25 and are to be completely coated with an asphaltic type varnish to prevent corrosion.

### 2.3 MANHOLE GRADE RINGS AND BLOCKS

.1 Precast grade rings and blocks for manhole grade adjustment shall conform to ASTM C478 and C139, respectively.

### 2.4 MORTAR

.1 Mortar shall be Sulphate Resistant ASTM Type 50.

.2 Mortar used for sealing pipe penetrations shall consist of one part cement to two parts of clear sharp sand

## PART 3. EXECUTION

.1 General

.1 All manholes, valves and service boxes shall be raised, lowered, or remain at 10 mm below final grade. Asphalt pavement shall be tapered up in a 0.3 m radius, measured from the exterior circumference of the appurtenance. An application of a fog coat shall be applied to the surrounding area upon completion. Metal risers for raising the manhole cover only will not be allowed.

.2 Valve Boxes

.1 The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be so made that the valves operate effectively.

.2 If the top box fails to move, risers can be used to bring it to grade.

.3 Manholes

.1 Manhole and catch basin covers shall be adjusted so that the cover conforms to the required elevation. All adjustments are to be made with mortar and brick or grade rings firmly set in position and grouted.

.2 Mortar must completely fill any spaces between collars, and the top slab and frame, in order to provide a continuous bearing surface. Mortar must be trowelled smooth with the inside of the collars. Mortar must not be applied to the inside of the collars.

.3 The slab top, collars and frame shall be level and true, and shall not rock when stacked. A layer of mortar, not exceeding 1.0 cm in thickness, shall be placed between the slab top, all collars, and the frame as a bonding and leveling course.

.4 Where the height of adjustment does not permit use of a full precast collar, or the frame must be on an angle to suit the surface grades, the following shall apply:

.1 Use iron or steel wedges, brick, or a combination of wedges and brick to support the frame. Once correct height and grade has been confirmed, the full width of the space under the frame shall be filled with mortar, or mortar and brick, depending on the space required to be filled.

.2 The amount of mortar shall be minimized. It may be necessary to temporarily lift the frame in order to place the brick and mortar, so that the full bearing surface of the frame will be supported.

.3 Care must be taken when removing and reinstalling the frame to ensure height and slope is maintained.

.5 Collars and bricks must be installed in vertical alignment.

.4 Water Valves

.1 Excavate and expose adjustable portion of water valve casing.

.2 Adjust water valve casing to design elevation.

.3 Recess top of water valve 5 mm below finished asphalt surface elevation or to a maximum of 25 mm below finished gravel lane surface.

.4 Provide gravel cap on all buried vales.

.5 Backfill excavation. Ensure water valve casing will not settle.

.6 Operate valve in presence of Departmental Representative to verify it is operational.

.5 Hydrants

.1 Excavate and expose top extension section of fire hydrant.

.2 Remove existing extension section and hydrant rod and replace with appropriate unit to place hydrant within 25 mm of design elevation.

.3 Operate hydrant in presence of Departmental Representative to verify it is operational.

.6 Backfill

.1 Should any backfill be required around the valve box, manhole or catch basin cover below the elevation of the road base course surface, crushed gravel (20 mm) shall be used and properly compacted in place.

**END OF SECTION**

# PART 1. GENERAL

## 1.1 DESCRIPTION

.1 This Section specifies requirements for installation of potable water distribution mains, service lines and appurtenances using the open trench method.

## 1.2 RELATED WORK

| | | |
|---|---|---|
| .1 | 01 35 29 | Health and Safety Requirements |
| .2 | 01 35 43 | Environmental Procedures |
| .3 | 01 41 00 | Regulatory Requirements |
| .4 | 01 43 00 | Quality Control |
| .5 | 01 51 00 | Temporary Utilities |
| .6 | 01 656 00 | Temporary Barriers and Enclosures |
| .7 | 31 23 33 | Excavating, Trenching and Backfilling |
| .8 | 33 05 14 | Adjustment of Manholes, Hydrants and Water Valves |

## 1.3 DEFINITIONS

.1 Working Pressure – maximum sustainable pressure during normal system operation. Based on difference maximum reservoir or pump head less the lowest system elevation.

.2 Pressure Class – Maximum sustainable pressure rating for a pipe product.

.3 Surge Pressure – Short term pressure spike caused by sudden change of velocity in a pipeline.

.4 Test Pressure – Short term test pressure to be applied in field on completed pipeline.

## 1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of pipe embedment materials and provide a sieve analysis for pipe embedment materials to the Engineer. A sieve analysis of the pipe embedment materials shall be submitted prior to use when the source and material changes.

.3 Submit manufacturer's test data and certification that pipe materials meet requirements of this section a minimum of 2 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

.4 Pipe certification to be marked on pipe.

.5 A Filling, Swabbing and Pressure Testing Plan shall be submitted to the Departmental Representative for review. The Pressure Testing Plan shall include the following at a minimum for each test section:

.1 Start and end stations for each test section

.2 Location of pressure gauges and filling location(s)

.3 Description of temporary bulkheads or caps used to isolate each test section

.4 Filling rate, air release and flow control measures to be employed during filling

.5 Proposed water supply source

.6 Description of the proposed pressurization system

.7 Means employed to facilitate the measurement of makeup water

.8 Method of dewatering the test section following testing including, erosion control, flow control measures and water disposal locations.

## 1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details.

.1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

.3 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, valve boxes, valve chambers, hydrants, metering vaults, heat tracers and winter shut down 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.

## 1.7 QUALITY CONTROL INSPECTION AND TESTING

.1 Inspection

.1 The Manufacturer shall afford the Departmental Representative every facility to access and inspect all plant to be provided, work to be performed, materials to be supplied and equipment or machinery to be installed in accordance with the provisions of the applicable AWWA and CSA specifications.

.2 Testing of Pipe and Materials

.1 The Manufacturer shall provide access to the Departmental Representative to conduct plant inspections.

.2 The Departmental Representative reserves the right to conduct third party quality control testing.

.3 The Manufacturer shall make, conduct, arrange, make available, obtain and provide for all testing as described the relevant AWWA and CSA specifications.

## 1.8 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services. Necessary interruptions must meet Section 01 14 00 - Work Restrictions.

.2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.

.3 Notify Departmental Representative minimum of 7 days in advance of interruption in service with confirmation of time and duration minimum of 24 hours before.

.4 Notify fire department of any planned or accidental interruption of water supply to hydrants.

.5 Provide and post "Out of Service" sign on any hydrant not in use.

.6 Advise local police department of anticipated interference with movement of traffic.

## PART 2. PRODUCTS

### 2.1 PIPE, JOINTS AND FITTINGS

.1 Polyvinyl Chloride (PVC) Pressure Pipe

.1 For pipe sizes 100 mm to 300 mm in diameter, all pipes and joints shall be to the latest revision AWWA C900, CSA certified as meeting latest revision CSA 3- B137.3-M86.

.2 Minimum Dimension Ratio DR 18 and working pressure rating 235 psi.

.3 All PVC pipe to be cast iron outside diameter, bell end, c/w SBR or NBR gaskets of a pressure actuated seal design.

.4 All PVC pipe to be capable of deflecting at a joint and supplied with integral wall thickened bell ends and continuous gaskets.

.2 Polyvinyl Chloride (PVC) Fittings

.1 For main sizes 300 mm and smaller, PVC Fittings to the latest revision AWWA C-907, CSA certified as meeting latest revisions CSA 3-B137.2, DR 18, pressure class 150, bell ends, c/w 1 MPa elastomeric gasket joint.

.3 Joint Restraints

.1 PVC joint restraints shall be constructed of ductile iron to ASTM A536 Grade 65-45-12, EBAA Iron Series 2500, Uniflange Series 1360 or approved equal.

.2 Joint restraints shall be epoxy coated with stainless steel bolts. Below grade restraints shall also be coated with petrolatum primer paste, tape and outerwrap.

.4 Cross-linked Polyethylene (PEX) Water Service Pipe

.1 Potable water service connection lines 20 mm to 50 mm diameter shall be cross-linked polyethylene (PEX) pipe manufactured in accordance with CSA B137.5 and ASTM F876 and shall comply with NSF 14. The pipe and resin (compound) shall be manufactured in an ISO 9001 certified production facility. The degree of cross linking for Municipex pipe shall not be less than 80% when tested in accordance to ASTM D2765 Method B. Municipex pipe shall have CSA / NSF approved pressure rating of:

.1 160 psi @ 23 degree C / 73.4 degree F

.2 100 psi @ 82 degree C / 180 degree F

.3 80 psi @ 93 degree C / 200 degree F

.2 The outside diameter of the pipe shall be copper tube size (CTS) and shall have a standard dimension ratio (SDR) 9.

.3 The pipe shall carry the following marks every 5 feet minimum: manufacturer's name, nominal size, ASTM, CSA 7 NSF designations, SDR, pressure/temperature rating, potable tubing, manufacturing date & Machine number and footage mark. The pipe shall have consecutive footage marks every 5 feet (minimum starting with 0 at the beginning of each coil). The pipe shall be shipped in protective cardboard boxes marked with the product name and size. When connecting Municipex or Blue 904 to main cocks and service valves, stainless steel inserts shall be used.

.5 Tracer Wire to be an electric #14 AWG Solid SBC (1/64") polyethylene insulated wire or metal tape detectable to 3 m bury.

## 2.2 GATE VALVES AND VALVE BOXES

.1 Valves shall be ductile iron body, resilient wedge gate valves, conforming to latest revision AWWA C509, and is ULC, UL or FM approved, with fully rubber encapsulated solid wedge, non-rising stem, suitable for direct bury.

.2 Valve body to be constructed of cast iron, in accordance with ASTM A126, Class “B”. All nuts, bolts and washers to be stainless steel.

.3 Bronze valve stem to be operated by a 50 x 50 mm square operating nut. The valve stem (stuffing box) shall contain a double “O” ring seal.

.4 Valve ends to be push-on “Tyton Joint” conforming to latest revision of AWWA C111-85/ANSI A21.11.

.5 Valves to open counter clockwise (turn left to open).

.6 Design working pressure shall be 1,035 kPa (150 psi).

.7 All valves shall be supplied with a circular bottom box guide plate. Metallic type guide plates shall be coated with Type A coating conforming to AWWA C213.

.8 The exterior of all buried distribution valves shall be factory coated with Type B coating.

.9 The interior of valves to be epoxy coated, as per latest revision AWWA C550.

.10 For 20 mm & 25 mm service valves the Type A operating rod shall be used and for 40 mm & 50 mm service valves the Type B operating rod shall be used.

## 2.3 STAND PIPES

.1 Hose bibs shall be forged brass with 19 mm male threaded connection, lead free, approved for potable water applications, PTFE seating and NBR O-ring.

.2 All stand pipes shall be equipped with two hose bibbs.

.3 Pipe assembly shall be secured to timber post as detailed.

## 2.4 HYDRANTS

.1 Hydrants shall be ULC (Underwriter Laboratories of Canada), UL (Underwriter Laboratories, US) or FM (Factory Mutual Fire Insurance Company) approved and conform to AWWA C502 with a design working pressure of 1,035 kPa (150 psi).

.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.

.5 Outlet nozzles shall be fastened into the barrel by a threaded or approved bayonet connection. The drain valve shall close as the compression valve starts to open. The interface between the removable parts of the main valve assembly and the hydrant body shall be bronze to bronze. The operating nut shall be three-sided, 32 mm on each side, and shall turn counter-clockwise (left) to open.

.6 Hydrants shall have two hose connections 65 mm diameter at 180 degrees and one 100 mm diameter pumper connection with Alberta Mutual Aid Standard.

.7 The hose connection outlets shall be supplied with cast iron caps, factory lubricated for ease of removal. The caps shall not be tethered to the hydrant body.

.8 Hydrants shall be supplied with a single 150 mm barrel and stem extension located immediately below the grade-line flange and shall have a minimum of one stem guide.

.9 The dimension from the grade line flange to the centreline of the lowest outlet nozzle shall be a minimum of 460 mm.

.10 The exterior of the hydrant above and 300 mm below the grade line flange shall be coated with Type C coating.

.11 Hydrant bodies and bonnet shall be painted with Yellow exterior enamel, representing 150 mm diameter supply main in road.

.12 All nuts, bolts and washers to be stainless steel.

## 2.5 COATINGS

.1 Type A: The coating material shall be a 100% solid, thermosetting, fusion bonded, dry powder epoxy resin, approved for contact with potable water by the National Sanitation Foundation (NSF).

.1 The surface preparation shall conform to Sec. 3.2 of AWWA C213. Coatings shall be applied to a preheated surface by the fluidized bed method or the electrostatic powder spray gun method.

.2 Epoxy coating thickness shall be 15 mils, plus or minus 5 mils maximum.

.3 Powders shall be one of the following products or approved equal:

.1 Valspar, D 1003 LD, Valspar, G 1003-RB

.2 Nap-Gard Mark X 7-2500

.3 3M, Scotchkote 134, Scotchkote 206N

.4 Plascote PPA 571HES (for service boxes and cast fittings only)

.2 Type B coating material shall be one of the following or an approved equal:

.1 Liquid Epoxy Coating System:

.1 Primer: The primer shall be one of the following or approved equal:

.1 Valspar 13-R-159

.2 Amercoat 83HS

.3 Carboline 893

.2 The topcoat shall be one of the following or approved equal:

.1 Valspar 89 series

.2 Bar-Rust 235

.3 Amercoat 385

.3 The primer and top-coat materials shall be cold applied with brushing or spray equipment in accordance with the coating Manufacturer's Specifications. The thickness and applications shall be as follows:

| Material | Min. Thickness | Max. Thickness | Applications |
|---|---|---|---|
| Primer | 0.05 mm (2mils) | 0.08 mm (3 mils) | 1 coat min. |
| Top Coat | 0.30 mm (12 mils) | 0.80 mm (30 mils) | 2 coats min. |
| Total | 0.35 mm (14 mils) | 0.88 mm (33 mils) | 3 coats min. |

.3 Type C coating system shall consist of a Type B coating system and the following finish coat application:

.1 The finish coating material shall be a single component, liquid Alkyd Enamel or a single component liquid modified polyurethane copolymer. Coatings shall be one of the following products or approved equal:

.1 Valspar, M & F Enamel 20 Series

.2 Carboline, Admiral GP-62 Finish

.3 Carboline 139

.4 Amercoat 5450

.2 This coating material shall be applied over the Type B coating system with brush or spray equipment in accordance with the coating Manufacturer's Specifications to a minimum thickness of 0.05 mm (2 mils).

.3 The total thickness of the Type C Coating System shall be 0.4 mm (16 mils) min. and 0.93 mm (35 mils) max.

## 2.7 CATHODIC PROTECTION

.1 Exterior of buried valves and exterior of hydrant barrel below grade flange shall be factory coated with epoxy coating system conforming to AWWA C210.

.2 Exterior of all fittings, exterior and interior of all valve boxes shall be factory coated with fusion bonded epoxy coating conforming to AWWA C213.

.3 Interior of valves and hydrants shall be coated in accordance with AWWA C550.

.4 Zinc anodes shall conform to ASTM B418. Type II anodes shall have a minimum open circuit potential of –1.10 volts referenced to Cu/CuSO4 and shall have the following composition:

| | |
|---|---|
| Aluminum | 0.005% maximum |
| Cadmium | 0.003% maximum |
| Iron | 0.0014% maximum |
| Lead | 0.003% maximum |
| Copper | 0.002% maximum |
| Zinc | remainder |

.5 Anode lead wires shall be a minimum of 2 metres long of AWG #10 type RWU, XLPE stranded copper conforming to CAN C22.2 No. 38. Lead wire connection shall be silver-soldered (brazed) to the steel core using a suitable filler material and flux.

.6 All metallic buried fittings and valves shall be cathodically protected with 2.3 kilogram zinc anodes and all hydrants shall be cathodically protected with 5.5 kilogram zinc anodes.

## 2.8 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:

.1 Well rounded or fractured gravel:

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks to Section 03 30 00.01 - Cast-in-Place Concrete.

**2.9 BACKFILL MATERIAL**

.1 As indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**2.10 PIPE DISINFECTION**

.1 All new water mains and existing mains which are temporarily drained due to connections with the new mains shall be disinfected and flushed before being put into services in accordance with the latest edition of AWWA Standard C651 for Disinfecting Water Mains.

## PART 3. EXECUTION

**3.1 PREPARATION**

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of Departmental Representative.

.2 Remove defective materials from site .

**3.2 TRENCHING**

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Ensure trench depth provides for a minimum coverage over pipe of 900 mm from finished grade or as indicated on the drawings.

.3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

**3.3 CONCRETE BEDDING AND ENCASEMENT**

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.1 Place concrete to details as indicated.

.2 Valves, hydrants and fittings may be positioned on concrete blocks to facilitate placing of concrete.

.3 When necessary, anchor pipe to prevent flotation when concrete is placed.

.4 Do not backfill over concrete within 24 hours after placing.

**3.4 PIPE EMBEDMENT ZONE**

.1 Construction in pipe embedment zone shall conform to ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as noted herein.

.2 Place and construct bedding, haunch and initial backfill materials to details indicated in Section 31 23 33.01 - Excavating, Trenching and Backfilling and as indicated on the drawings.

.3 Shape bed true to grade to provide continuous, uniform bearing surface for pipe and fitting exterior. Do not use blocks or other materials that would exhibit point loads on the pipe.

.4 Shape transverse depressions as required to receive joints, bells and fittings as required.

.5 Compact the bedding to at least 90% standard proctor maximum dry density with the exception of the middle 1/3 of pipe diameter. Do not compact middle 1/3 of pipe diameter.

.6 Place haunch and initial backfill to 300 mm above the crown of the pipe. Compact in maximum 150 mm lifts and compact to 90% standard proctor maximum dry density.

.7 Do not place or construct frozen material in the pipe embedment zone. During freezing weather conditions, heat the pipe embedment material as necessary to provide enough free moisture to facilitate compaction as specified. A bedding stone material installed as specified may be used during freezing conditions provided the material has less than 1% passing the 0.075 mm sieve and is a processed aggregate approved by the Departmental Representative. The Contractor shall demonstrate that the compactibility of the clean material is not sensitive to freezing temperatures.

.8 Monitor pipe diameter in vertical and horizontal dimension while placing haunch material. Ensure pipe remains round while placing haunch material.

## 3.5 PIPE INSTALLATION

.1 Lay and join pipes in accordance with AWWA Manual M23 and Manufacturer's instructions, recommendations and specifications.

.2 Handle pipe by methods approved by Departmental Representative and recommended by pipe Manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.3 Lay pipes on prepared bed, true to line and grade.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.2 Take up and replace defective pipe.

.3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.

.4 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade

.5 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.6 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

.1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.7 Position and join pipes with equipment and methods approved by Departmental Representative.

.8 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.9 Bevel or taper ends of PVC pipe to match fittings.

.10 Align pipes before joining.

.11 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.

.12 Avoid displacing gasket or contaminating with dirt or other foreign material.

.1 Remove disturbed or contaminated gaskets.

.2 Clean, lubricate and replace before jointing is attempted again.

.13 Complete each joint before laying next length of pipe.

.14 Minimize deflection after joint has been made.

.15 Apply sufficient pressure in making joints to ensure that joint is completed to Manufacturer's recommendations.

.16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.19 Do not lay pipe on frozen bedding.

.20 Perform hydrostatic and leakage tests and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.

.21 Under no circumstances shall equipment that exceeds the structural capacity of the pipe be allowed direct access over the pipe until sufficient cover has been obtained. The Contractor shall be solely responsible for ensuring the equipment used during construction operations is carefully selected and staged such that the pipe is not damaged or displaced.

.22 Backfill remainder of trench.

## 3.6 HORIZONTAL AND VERTICAL TOLERANCES

.1 Pipes shall be installed according to the lines and grades shown on the plans or as staked in the field by the Departmental Representative. The Contractor shall transfer line and grade to the pipe by means of an approved batter board and boning rod system, laser beam system, or other system approved by the Departmental Representative.

.2 Variance from vertical alignment shall not vary more than 25 mm. Notwithstanding this tolerance, any vertical grade variation shall not result in a reversal of slope or grade from that indicated on the drawings. The Contractor is solely responsible for correcting grade alignments that do not meet the design intent.

.3 Where proposed vertical inflections cannot be achieved at one joint deflection, the Manufacturer’s maximum joint deflection allowances shall govern over the maximum allowable tolerance for vertical elevations and the vertical inflection shall be achieved over a sufficient number of joints to achieve the inflection without any reversal of pipe grade and minimizing variance from proposed pipe elevations on the drawings.

.4 Variance from the horizontal alignment shall not exceed 200 mm.

## 3.7 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations and in accordance with details on the drawings. Ensure valve box adjustable range is suitable for pipe burial depth.

.2 Valves are not to be supported by the pipe.

.3 All flanged connections between valves and pipes or fittings shall be made electrically continuous by carefully removing sufficient coating from the bolt bearing surface on the rear of the flange, such that the flange fasteners will be in direct contact with the flange when tightened. Continuity shall be provided through at least two bolts per flange connection.

.4 Provide a valve box on each valve that is direct buried. Valve box to be installed straight and plumb. Centre on valve and set top of box at finished grade. Provide valve extension rod in valve box.

## 3.8 SERVICE CONNECTIONS

.1 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.

.2 Construct service connections at right angles to water main unless otherwise directed.

.3 Curb stops must be at lowest point in service line to allow for drainage. Minimum one meter from water main to prevent washing out of bedding material from draining curb stop.

.4 Locate curb stops as shown on the drawings.

.5 Tappings on PVC-C900 pipe may be threaded without service clamps.

.1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.

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

| Pipe Diameter (mm) | Maximum Tap Without Clamp (mm) | Maximum Tap With Clamp (mm) |
|---|---|---|
| 100 | 20 | 25 |
| 150 | 20 | 25 |
| 200 | 20 | 25 |

.6 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.

.7 Tappings for PE pipe: PE tapping tees or multi-saddle tees.

.8 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.9 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.

.10 Install multiple corporation stops, 30 degrees apart around circumference of pipe and minimum of 300 mm apart along pipe.

.11 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m minimum, whichever is greater.

.12 Leave corporation stop valves fully open.

.13 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

.14 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.

.15 Install curb stop with corporation box on services NPS 2 or less in diameter.

.1 Equip larger services with gate valve and cast iron box.

.2 Set box plumb over stop and adjust top flush with final grade elevation.

.3 Leave curb stop valves fully closed.

## 3.9 HYDRANTS

.1 Pumper and hose nozzles shall be located a minimum of 460 mm above ground flange. Nozzle threads to conform to Alberta Mutual Aid Standard.

.2 Hydrant valve opening to be 133 mm. Valve seat and valve body to be of bronze construction.

.3 Hydrants shall be opened by turning hydrant operating nut left (counter clockwise).

.4 Depth of bury to be 1.0 m.

.5 Hydrant branch line to be 150 mm diameter PVC pipe conforming to this Section, including 150 mm tee fitting at the main and 150 mm gate valve.

.6 Hydrant bodies and bonnets to be painted with exterior enamel. After installation, paint pumper and hose nozzle caps using exterior enamel in accordance with following colour code:

| Watermain Diameter | Colour |
|---|---|
| 100 mm | Red |
| 150 mm | Yellow |
| 200 mm and larger | Black |

.7 Hydrants to be constructed with break-a-way flange, c/w safety stem (spindle). Coupling is to be located at ground level.

## 3.10 THRUST BLOCKS AND RESTRAINED JOINTS

.1 For thrust blocks: do concrete work in accordance with Section 03 30 00.01 – Cast-in-Place Concrete.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within 24 hours after placing.

.5 For restrained joints: only use restrained joints approved by Departmental Representative.

.6 Place thrust blocks against undisturbed soil to meet the soil bearing requirements provided on the drawings.

.7 Provide special design if required bearing surface cannot be achieved.

## 3.11 CATHODIC PROTECTION

.1 Provide cathodic protection for cast iron fittings, valves, and metallic couplers.

.2 Cadweld or thermoweld anode lead to each valve, metallic coupler and fitting as follows:

.1 Remove portion of coating on valve or fitting to be cadwelded or thermowelded.

.2 Thoroughly clean area and file metal until a shiny, roughened surface is obtained approximately 75 mm square.

.3 Remove insulation and crimp copper sleeve over bared wire covering the length to be cadwelded or thermowelded.

.4 Use crucible and weld metal as manufactured by Erico Products Inc., cadweld or thermoweld, or equal, and to manufacturer's recommendations.

.3 Remove slag off completed weld and file smooth any sharp edges.

.4 Thoroughly coat the weld and area adjacent that has had the coating removed with Polyken 927 primer with Polyken 930 tape.

.1 Install anodes as follows:

.1 Install the number and size of anodes and at locations indicated.

.2 Remove anode from plastic bag, leaving cloth bag or cardboard tube intact. Do not lift anode by lead wire.

.3 Place anodes a minimum of 1 m from fitting in a horizontal position and at same elevation and parallel to the fitting.

.4 Ensure soil is tamped uniformly around each anode to eliminate voids of air pockets.

.5 Wrap anode wire once around appurtenance.

.6 Cadweld or thermoweld anode wire leads to fitting or valve.

.5 Prior to coating and/or wrapping each cadwelded or thermowelded junction, the Contractor shall take a resistance measurement of all pairs of anode lead wires. This measurement shall be taken with an ohmmeter after installation has been completed. A resistance value of less than 0.5 ohms shall be considered satisfactory.

## 3.12 PIPE SURROUND

.1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.1 Do not dump material within 0.6 m of pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% of corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 95% of corrected maximum dry density.

## 3.13 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Under Paving and walks, compact backfill to at least 98% corrected maximum dry density.

.1 In other areas, compact to at least 98% corrected maximum dry density.

## 3.14 TRACE WIRE

.1 Tracer wire shall be installed simultaneously with the pipe on all mains and services.

.2 Splicing of the tracer wire can be done by soldering only. The connection shall be sealed with mastic and electrical tape. The Contractor shall be responsible for ensuring electrical continuity of the completed system.

.3 The tracer wire shall be brought above ground at every valve box riser, at every road crossing, at every facility location and at each end of every pipe section, It shall be brought above ground inside a rigid PVC conduit and looped inside a PVC junction box. The junction box shall be mounted to a marker post and be complete with a blank weatherproof cover. The wire shall be coiled inside these junction boxes. Rigid PVC conduit need only extend 1 m below grade at valve boxes and shall extend down to the waterline at all other locations.

.4 The tracer wire shall be installed on the top centreline of the pipe. Allowable tolerances will be a maximum of 25 mm clearance between the tracer wire and the pipe and 10o either side of the top of pipe. Tracer wire shall be attached to pipe in a manner acceptable to the Departmental Representative.

## 3.15 HYDRANT FLOW TESTS

.1 Conduct flow tests on every hydrant to determine fire flows prior to painting hydrant caps and ports.

## 3.16 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with AWWA M23.

.2 System working pressure shall be taken to be 100 psi.

.3 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.4 Notify Departmental Representative at least 24 hours in advance of proposed tests.

.1 Perform tests in presence of Departmental Representative.

.5 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.6 Test pipeline in sections not exceeding 100 m in length, unless otherwise authorized by Departmental Representative.

.7 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.

.8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.

.9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.10 Open Valves.

.11 Expel air from main by slowly filling main with potable water and expelling air at stand pipes located at high points where no vacuum release valves are installed.

.12 Thoroughly examine exposed parts and correct for leakage as necessary.

.13 Apply hydrostatic test pressure based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.

.14 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.15 Repeat hydrostatic test until defects have been corrected.

.16 Apply leakage test pressure after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.

.17 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.

.18 Locate and repair defects if leakage is greater than amount specified.

.19 Repeat test until leakage is within specified allowance for full length of water main.

.20 The test section will not be accepted if the actual leakage measured in litres exceeds the quantity determined by the following formula:

$$L_{PVC} = \frac{ND(P)^{0.5}}{130{,}400}$$

$L_{PVC}$ = Allowable leakage in litres per hour
N = Number of joints in the test section (Including all associated appurtenances)
D = Nominal diameter of the pipe in millimetres
P = Average Test Pressure in kilo pascals (kPa)

.1 Allowable leakage calculations for pipe types other than PVC shall be done in accordance with current AWWA Standards.

## 3.17 FLUSHING AND DISINFECTING

.1 Provide all labour, equipment, temporary features and materials required to perform filling operations using water as specified herein and in accordance with the Filling, Swabbing and Pressure Testing Plan.

.2 The Contractor is responsible for all safety precautions and protection of the pipe and appurtenances during the swabbing.

.3 Swabbing and flushing shall be done in accordance with the Manufacturer's recommendations.

.4 Foam swabs shall be used and all swabs used shall be accounted for and removed from the system following swabbing.

.5 Flushing in stages will be required to meet the continuity of water services to the areas specified in Section 01 14 00 Work Restrictions and tie in requirements with adjacent areas.

.6 Flushing and disinfecting operations: witnessed by Departmental Representative.

.1 Notify Departmental Representative at least 7 days in advance of proposed date when disinfecting operations will begin.

.7 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.

.8 Flushing flows as follows:

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

.9 Provide connections and pumps for flushing as required.

.10 Open and close valves, hydrants and service connections to ensure thorough flushing.

.11 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.

.12 Disinfect water mains.

.13 Rate of chlorine application to be proportional to rate of water entering pipe.

.14 Chlorine application to be close to point of filling water main and to occur at same time.

.15 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.16 Flush line to remove chlorine solution after 24 hours. De-chlorination required prior to any discharge unless otherwise approved by Departmental Representative. Provide de-chlorination methodology and procedure to Department Representative for approval.

.17 Measure chlorine residuals at extreme end of pipe-line being tested.

.18 Perform bacteriological tests by a certified laboratory on water main samples for E.coli and total coliform, after chlorine solution has been flushed out.

.1 Test three samples.

.2 Should contamination remain or recur during this period, repeat disinfecting procedure.

.19 Take water samples at the farthest hydrants and service connections, in suitable sequence, to test for chlorine residual.

.20 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.

.1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

## 3.18 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition.

## 3.19 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 DESCRIPTION

.1 This Section specifies requirements for installation of sanitary sewer collection mains, service lines and appurtenances using the open trench method.

### 1.2 RELATED WORK

| | | |
|---|---|---|
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| .2 | 01 35 43 | Environmental Procedures |
| .3 | 01 41 00 | Regulatory Requirements |
| .4 | 01 43 00 | Quality Control |
| .5 | 01 51 00 | Temporary Utilities |
| .6 | 01 656 00 | Temporary Barriers and Enclosures |
| .7 | 31 23 33 | Excavating, Trenching and Backfilling |
| .8 | 33 05 14 | Adjustment of Manholes, Hydrants and Water Valves |

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate on drawings proposed method for installing carrier pipe for undercrossings.

.3 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.4 Certification to be marked on pipe.

.5 Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.

### 1.4 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.

### 1.5 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services. Necessary interruptions must meet Section 01 14 00 - Work Restrictions.

.2 Schedule Work to minimize interruptions to existing services and maintain sewage flows during construction.

.3 Do not interrupt sanitary service for more than 6 hours and confine this period between hours approved by the Departmental Representative.

.4 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.

.5 Notify Departmental Representative minimum of 7 days in advance of interruption in service.

## PART 2. PRODUCTS

### 2.1 PIPE AND FITTINGS

.1 Smooth Wall Polyvinyl Chloride (PVC) Pipe

.1 For sewer collection mains of pipe size 150 mm to 375 mm diameter, pipe and fitting material shall be PVC gravity sewer pipe to latest revision ASTM D3034, certified as meeting latest revision CSA B182.2-M, SDR 35, integral locked-in gasket with bell and spigot system.

.2 For sewer service lines of pipe size 100 mm to 150 mm diameter, pipe and fitting material shall be PVC gravity sewer pipe to latest revision ASTM D3034, certified as meeting latest revision CSA B182.1-M, SDR 28, integral locked-in gasket with bell and spigot joints.

.3 PVC insert type fitting ("Inserta-Tee") to be PVC PSM gasket joint stubs, c/w moulded rubber sleeve and adjustable stainless steel strap. Screw mechanism on straps to be completely stainless steel.

### 2.2 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to: Section 31 23 33 – Excavating, Trenching and Backfilling and the following requirements:

.1 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00.01 - Cast-in-Place Concrete.

.3 Pre-insulated pipes shall consist of expanded polyurethane foam with the following minimum properties:

.1 Thickness: 50 mm;

.2 Density: 35 kg/m³;

.3 Compressive Strength: 275 kPa;

.4 HDPE outer jacket thickness: 50 mils;

.5 Insulation shall be used where indicated on drawings when the depth of cover is less than 2.6 m. Joints shall be covered in mastic to ensure watertightness;

.6 Service lines connected to an insulated sewer main must also be insulated for the entire service line length.

### 2.3 BACKFILL MATERIAL

.1 In accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

## PART 3. EXECUTION

### 3.1 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.

## 3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Ensure trench depth provides for a minimum coverage over pipe of 1200 mm from finished grade or as indicated on the drawings.

.3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

.4 Protect trench from contents of sewer or sewer connection.

## 3.3 PIPE EMBEDMENT ZONE

.1 Construction in pipe embedment zone shall conform to ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as noted herein.

.2 Place and construct bedding, haunch and initial backfill materials to details indicated in Section 31 23 33 – Excavating, Trenching and Backfilling and as indicated on the drawings.

.3 Shape bed true to grade to provide continuous, uniform bearing surface for pipe and fitting exterior. Do not use blocks or other materials that would exhibit point loads on the pipe.

.4 Shape transverse depressions as required to receive joints, bells and fittings as required.

.5 Compact the bedding to at least 90% standard proctor maximum dry density with the exception of the middle 1/3 of pipe diameter. Do not compact middle 1/3 of pipe diameter.

.6 Place haunch and initial backfill to 300 mm above the crown of the pipe. Compact in maximum 150 mm lifts and compact to 90% standard proctor maximum dry density.

.7 Do not place or construct frozen material in the pipe embedment zone. During freezing weather conditions, heat the pipe embedment material as necessary to provide enough free moisture to facilitate compaction as specified. A bedding stone material installed as specified may be used during freezing conditions provided the material has less than 1% passing the 0.075 mm sieve and is a processed aggregate approved by the Departmental Representative. The Contractor shall demonstrate that the compactibility of the clean material is not sensitive to freezing temperatures.

.8 Monitor pipe diameter in vertical and horizontal dimension while placing haunch material. Ensure pipe remains round while placing haunch material.

## 3.4 PIPE INSTALLATION

.1 Lay and join pipes in accordance with AWWA Manual M23 and Manufacturer's instructions, recommendations and specifications.

.2 Handle pipe by methods approved by Departmental Representative and recommended by pipe Manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.3 Lay pipes on prepared bed, true to line and grade.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.2 Take up and replace defective pipe.

.3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.

.4 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade

.5 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.6 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

.1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.7 Position and join pipes with equipment and methods approved by Departmental Representative.

.8 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.9 Bevel or taper ends of PVC pipe to match fittings.

.10 Align pipes before joining.

.11 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.

.12 Avoid displacing gasket or contaminating with dirt or other foreign material.

.1 Remove disturbed or contaminated gaskets.

.2 Clean, lubricate and replace before jointing is attempted again.

.13 Complete each joint before laying next length of pipe.

.14 Minimize deflection after joint has been made.

.15 Apply sufficient pressure in making joints to ensure that joint is completed to Manufacturer's recommendations.

.16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.19 Do not lay pipe on frozen bedding.

.20 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available.

.21 Perform leakage tests and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.

.22 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.

.23 Under no circumstances shall equipment that exceeds the structural capacity of the pipe be allowed direct access over the pipe until sufficient cover has been obtained. The Contractor shall be solely responsible for ensuring the equipment used during

construction operations is carefully selected and staged such that the pipe is not damaged or displaced.

.24 Backfill remainder of trench.

## 3.5 HORIZONTAL AND VERTICAL TOLERANCES

.1 Pipes shall be installed according to the lines and grades shown on the plans or as staked in the field by the Departmental Representative. The Contractor shall transfer line and grade to the pipe by means of an approved batter board and boning rod system, laser beam system, or other system approved by the Departmental Representative.

.2 Variance from vertical alignment shall not vary more than 25 mm. Notwithstanding this tolerance, any vertical grade variation shall not result in a reversal of slope or grade from that indicated on the drawings. The Contractor is solely responsible for correcting grade alignments that do not meet the design intent.

.3 Where proposed vertical inflections cannot be achieved at one joint deflection, the Manufacturer's maximum joint deflection allowances shall govern over the maximum allowable tolerance for vertical elevations and the vertical inflection shall be achieved over a sufficient number of joints to achieve the inflection without any reversal of pipe grade and minimizing variance from proposed pipe elevations on the drawings.

.4 Variance from the horizontal alignment shall not exceed 200 mm.

## 3.6 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.1 Do not dump material within 0.6 m of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 95% corrected maximum dry density.

.7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

## 3.7 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.

.3 Under paving and walks and adjacent to all structures, compact backfill to at least 98% corrected maximum dry density.

## 3.8 SERVICE CONNECTIONS

.1 Install pipe to CSA B182.11and Manufacturer's instructions and specifications.

.2 Service connections to main sewer: Departmental Representative approved saddles.

.1 Do not use break-in and mortar patch-type joints.

.3 Service connection pipe: not to extend into interior of sewer main.

.4 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.

.1 Use long sweep bends where applicable.

.5 Plug service laterals with water tight caps or plugs as approved by Departmental Representative.

## 3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

## 3.10 VIDEO INSPECTION

.1 The inspection shall be made by employing television scanning equipment which shall be provided by the Contractor. The Contractor shall employ a NAAPI certified closed circuit television Contractor acceptable to the Departmental Representative to carry out the inspection. Submit copies of each of CCTV operator's current NAAPI certification certificate to the Departmental Representative at least one week prior to the start of the CCTV inspection operations

.2 All television inspection shall be carried out in the presence Departmental Representative who shall be given at least 48 hours advance 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.

.3 The closed circuit television Contractor shall provide all equipment and materials necessary to conduct the inspection as specified herein.

.4 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 any accuracy of one third of a meter per kilometre. Picture quality must be such to produce a continuous 400-line resolution picture showing the entire periphery of the pipe.

.1 The following capabilities and items must be available.

.1 Direct voice communication.

.2 Camera towing service.

.3 Self-contained electrical power.

.4 Proper safety equipment to protect employees and the general public.

.5 The cameras rate of progress shall be uniform during inspection and shall not exceed 0.2 m/s.

.6 Flush and clean pipe line immediately prior to CCTV inspection survey, unless otherwise specified in the control documents.

.7 All defect coding to conform to the standards and formats outlined in Water Research Centre (WRC) publication MSCC Manual of Sewer Condition Classification, Third Edition, 1993 including Addendum – February 1996.

.8 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 according to WRC.

.9 Photographs shall be taken as directed by 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.

.10 Manhole identity shall be noted clearly as indicated on the drawings.

.11 Two (2) copies of the final typewritten report with corresponding photographs secured properly and referenced to the text along with a copy of videos recorded on DVD shall be submitted within two weeks after completion of inspection.

.12 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.

## 3.11 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 Manually remove foreign material from sewers and manholes by hand and, upon approval from Departmental Representative, flush residual with water.

.3 Perform infiltration and exfiltration testing as soon as practicable after pipe installation is complete, and service connections have been installed.

.4 Do infiltration and exfiltration testing as specified herein.

.1 Perform tests in presence of Departmental Representative.

.2 Notify Departmental Representative 24 hours minimum in advance of proposed tests.

.5 Carry out tests on each section of sewer between successive manholes including service connections.

.6 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.7 Exfiltration test:

.1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in materials is complete before test measurements are begun.

.2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.

.3 Monitor water levels for 2 hour duration.

.4 Water loss at end of test period is not to exceed maximum allowable exfiltration over any section of pipe between manholes.

.8 Infiltration test:

.1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used.

.2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.

.3 Install watertight plug at upstream end of pipeline test section.

.4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter.

.5 Prevent damage to pipe and bedding material due to flotation and erosion.

.6 Place 90 degrees V-notch weir, or other measuring device approved by Departmental Representative in invert of sewer at each manhole.

.7 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.

.9 Infiltration and exfiltration is not to exceed the following limits in L per hour per 100 m of pipe, including service connections.

| **Nominal Pipe Diameter (mm)** | **Allowable Leakage PVC (L)** |
|---|---|
| 100 | 3.88 |
| 125 | 4.62 |
| 150 | 5.51 |
| 200 | 7.45 |
| 250 | 9.39 |
| 300 | 11.33 |
| 350 | 13.27 |
| 400 | 14.91 |
| 450 | 16.84 |

.10 Leakage: not to exceed following limits in litres per hour per mm of diameter per 100 m of sewer including service connections:

.1 Exfiltration, based on 600 mm head: 0.175 L.

.2 Infiltration: 0.150 L.

.11 Repair and retest sewer line as required until test results are within limits specified.

.12 Repair visible leaks regardless of test results.

**END OF SECTION**

## PART 1. GENERAL

### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

### 1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect conduits from damage.

.3 Replace defective or damaged materials with new.

## PART 2. PRODUCTS

### 2.1 SMOOTH WALL POLYVINYL CHLORIDE (PVC) CONDUIT

.1 The following suppliers:

.1 Carlon trenchless raceway, PVC; size as indicated on drawings

### 2.2 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3 in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## PART 3. EXECUTION

### 3.1 PREPARATION

.1 Clean conduits and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

### 3.2 TRENCHING

.1 Do trenching Work and ensure compaction is completed in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and conduit. Where possible and acceptable by AHJ, share trenches maintain minimum approved spacing according to drawings and underground utilities, codes and standards.

### 3.3 INSTALLATION

.1 Handle, lay and join conduit to manufacturer’s specifications.

.2 Lay conduits on prepared bed, true to line and grade with conduit inverts smooth and free of sags or high points.

.1 Ensure barrel of each conduit is in contact with shaped bed throughout its full length.

.3 Joint deflection not to exceed limits recommended by conduit manufacturer.

.4 Whenever Work is suspended, install removable watertight bulkhead at open end of last conduit laid to prevent entry of foreign materials.

.5 Red warning tape shall be placed at least 0.300m above buried conduit.

**3.4 CONDUIT SURROUND**

.1 Place surround material in unfrozen condition.

.2 Upon completion of conduit laying, and after Departmental Representative has inspected conduit joints, surround and cover conduits as indicated.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.4 Compact each layer from conduit invert to mid height of conduit to at least 98% SPDD within roadways and 95% everywhere else. Ensure compaction is completed in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

**3.5 BACKFILL**

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above conduit 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 98% corrected maximum dry density. In other areas, compact backfill to at least 95% corrected maximum dry density.

**3.6 FIELD TESTS AND INSPECTIONS**

.1 Repair or replace conduit, conduit joint or bedding found defective.

**3.7 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 SECTION INCLUDES

.1 Provision of rigid underground service ducts.

### 1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

.2 Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.

.3 Section 26 05 28 - Grounding - Secondary.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

### 1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA A23.1/A23.2-00 (June 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

### 1.4 REGULATORY REQUIREMENTS

.1 Co-ordinate and meet requirements of power supply authority. Ensure availability of power when required.

.2 The installation of the electrical facilities associated with FortisAlberta scope must be carried out by a FortisAlberta approved construction installer as per the requirements listed under the “Customer Installed Pre-Cast Base, Grounding and Ducting Process”. A list of approved contractors are available from the ForitsAlberta website at www.fortisalberta.com

## PART 2. PRODUCTS

### 2.1 MATERIALS

.1 Underground ducts: to Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts, rigid type DB2, size as indicated on drawings.

.2 Rigid steel galvanized conduit and fittings: to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.3 Conductors: copper, type RW-90, to Section 26 05 21, size and number of conductors as indicated on drawings.

.4 Concrete: to CSA A23.1/A23.2.

.5 Utility Metering: as per requirement of utility company.

## PART 3. EXECUTION

### 3.1 INSTALLATION

.1 Install cables in trenches and in ducts in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts. Use rigid steel conduit for that portion of the main service duct run above ground.

.2 Allow adequate conductor length for connection to supply by power supply authority.

.3 Allow adequate conductor length for connection to service equipment.

.4 All terminations shall be inside the power distribution equipment; no cables termination is allowed in in-ground junction boxes

.5 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

## 3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform additional tests if required by authority having jurisdiction.

**END OF SECTION**

# Appendix A

## Parks Canada Waterton Lakes National Park Approved General Project Best Management Practices

Parks Canada Parcs Canada

# Parks Canada
# Waterton Lakes National Park
# Approved General Project Best Management Practices

February 1, 2016

Version 1.0

Canada

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# Definitions

**Sensitive Features** are any areas designated by the IAO or through the EIA process as locations that require additional care and consideration for project activities. Examples of sensitive features include but are not limited to nests, dens and roosts, locations of cultural resources, critical habitat or residences for SAR, riparian areas, fescue grasslands, wildlife corridors, rare ecotypes, areas of management concern, etc.

The following is a list of **Sensitive Features** defined for this project.

| | |
|---|---|
| Cameron Creek | |
| Potential Bat Habitat (Buildings) | |
| | |
| | |

# Abbreviations

| | |
|---|---|
| BMP | Best Management Practices |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| DFO | Department of Fisheries and Oceans |
| EAS | Environmental Alignment Sheets |
| EI | Ecological Integrity |
| EIA | Environmental Impact Analysis |
| ERP | Emergency Response Plan |
| ESCP | Erosion and Sediment Control Plan |
| IAO | Impact Assessment Officer |
| LEED | Leadership in Energy and Environmental Design |
| PCA | Parks Canada Agency |
| PM | Project Manager / Functional Manager of Project |
| SAR | Species at Risk |
| SARA | *Species at Risk Act* |
| SO | Surveillance Officer |
| VC | Valued Component |
| WLNP | Waterton Lakes National Park |

# Introduction

The *Waterton Lakes National Park General Project Best Management Practices* will allow an identified suite of project activities to be undertaken in such a manner that there will not be resulting significant adverse environmental effects.

The Best Management Practice (BMP) pathway is applied when there is a suite of routine, repetitive projects or activities, with well understood and predictable effects. This fulfils Parks Canada's obligations under the *Canadian Environmental Assessment Act 2012* as a manager of federal land, see the **Guide to the Parks Canada EIA Process**. The BMP maximizes efficiency through creation of a pre-approved impact assessment for the defined suite of projects, to which standard mitigation and environmental management measures can be applied.

The impact assessment office (IAO) will review a proposed project and advise the functional manager of the project (PM) if and how this BMP should be applied. The IAO's advice will be based on whether the project falls within the scope of the BMP, and whether application of the mitigation measures in the BMP will adequately address potential adverse effects of the project.

Project Managers are responsible to ensure all mitigation measures applicable to the project are added to the terms and conditions of any permits or contracts issued for the project.

The Impact Assessment Officers must ensure the project, Environmental Impact Analysis (EIA) pathway applied and determination are recorded in the Parks Canada National Impact Assessment **Tracking System**.

These BMPs have been compiled from a number of available documents, as listed at the end of this document, and have been adapted to address the predictable effects of routine, repetitive project or activities within the Waterton Lakes Field Unit.

# Scope of Application

This BMP outlines the impact analysis of repetitive and routine projects[1]. Site security, worker safety and visitor safety are not included in the scope of this document. If a project involves some or all of below activities, and the initial assessment of site and project indicate "the project is unlikely to result in significant adverse environmental effects" the BMP can be applied. Projects that this BMP would likely be applied to include:

- The proposed maintenance, repair or upgrade of an **existing** development.
- **New** projects with restricted footprints that do not include sensitive habitats.
- Proposed restoration of **new** and **existing** developments.

For projects where further EIA is warranted, this BMP may be utilized as part of the mitigation package for the analysis. Therefore, this document also presents a minimum standard to provide

[1] For repetitive and routine projects on roadways, highways and parkways, refer to the Parks Canada National Best Management Practices - Roadway, Highway, Parkway and Related Infrastructure.

consultants and contractors for environmental protection measures on work sites. In these cases, additional protection measures and mitigations may be required.

# Exceptions

Supplemental analysis and/or mitigations are required for the following project activities:

- New projects or developments in natural areas;
- Projects adjacent to sensitive features;
- Work that may impact aquatic or terrestrial wildlife habitat connectivity, such as new fences or culverts;
- Physical works immediately adjacent to the international boundary;
- Elongation of culverts; realigning water courses; dredging; or work below the high water mark of a fish bearing water body;
- Bridge projects needing work to occur below the High-Water Mark[2], with permanent alteration to the water course, such as replacement of piers/abutments or permanent installation of structures on the bed of a water body;
- Greater than 5% increase in land use footprint (e.g. project expansion); and,
- Work which might adversely impact any potential or established Aboriginal and Treaty rights or traditional use[3].

If the project has the potential to have an adverse effect on the critical habitat of a species at risk (with endangered, threatened, or extirpated status) the project will require a separate environmental impact analysis.

If the project has the potential for **residual** adverse effects on a listed species at risk (including effects to individuals and residence of the individuals) the project will require a separate environmental impact analysis.

**Note:** If there is any uncertainty regarding potential adverse effects to species at risk, consult a member of the **National Office Species Conservation team**.

# Approved Geographic Area of Application

This BMP is intended for use on projects completed in Waterton Lakes National Park (WLNP).

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2 High-water Mark is the usual or average level to which a body of water rises at its highest point and remains for a sufficient time so as to leave a mark on the land. (Fisheries and Oceans, 2015).

3 Parks Canada must engage in additional and separate consultations with Aboriginal groups if there is a possibility of a project adversely affecting established or potential Aboriginal or Treaty rights. This is required to fulfill federal government responsibilities in upholding the honour of the crown. If there is uncertainty regarding the need for Aboriginal consultation with respect to a project, refer the matter to Parks Canada Legal Services for advice. Guidance on consultation may be sought from the **Aboriginal Affairs Secretariat** and from the guidance document "**A Handbook for Parks Canada Employees on Consultation with Aboriginal Peoples**".

# Roles and Responsibilities during Construction

The following is a select list of key roles that will be in place during the construction program[4]. The responsibilities of the key roles are not limited to those that are stated below, as this is a select list of roles most relevant to compliance with environmental commitments and regulations for projects where the proponent is the Parks Canada Agency (PCA).

### *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 as and supporting documents and conducts pre-construction meetings and chairs project team meetings. Note that where the proponent of a project is external to Parks Canada, a functional manager of the project within the Agency is designated.

### *Project Inspector*

The Project Inspector reviews plans for compliance to building codes and development guidelines. The Project Inspector performs inspections on behalf of the Project manager and monitors contract compliance in consultation with procurement office. The Project Inspector is responsible for keeping daily logs.

### *Project Leader*

The Project Leader is accountable for the overall success of the project. The Project Leader recommends approval to proceed to the construction phase and approves changes in scope, budget or schedule in consultation with Procurement Officer.

### *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 to the Parks Canada 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 Parks Canada 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.

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[4] The list of roles and key responsibilities have been modified from the PCA document *Construction Site Roles and Responsibilities*.

*Consultants*
Consultants recommend contract amendments, reviews and approves shop drawings and provides advice on project compliance. Consultants perform inspections on behalf of the Project Manager.

*Environmental Consultants*
Under the direction of the IAO, environmental consultants are responsible for producing deliverables as required for the Project, including, but not limited to: Environmental Impact Assessment, site-specific mitigation strategies, Environmental Alignment Sheets (EAS), Environmental Management Plan.

*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 403-859-2636*
Banff dispatch provides WLNP with 24 hour emergency dispatch services and will connect callers with emergency or other Parks Canada services as required (e.g., Warden/Law Enforcement Services, Duty Officers).

# Environmental Overview

## Environmental Setting

Waterton Lakes National Park (WLNP) occupies approximately 505 km² in the southwest corner of Alberta in the southern Rocky Mountains. WLNP forms part of the Waterton-Glacier International Peace Park, and is a designated UNESCO World Heritage Site due to its significant ecological, scenic and cultural values. The park is rich in biodiversity, which includes 1001 vascular plant species, 23 fish species, 6 amphibian species, 4 reptile species, 62 mammal species and over 250 bird species.

As part of the Crown of the Continent ecosystem, WLNP makes up part of a north-south wildlife corridor including migratory bird and bat flight pathways (Lausen 2012). Five ecoregions - foothills parkland, montane, lower subalpine, upper subalpine and alpine – are represented within WLNP boundaries.

Refer to **Appendix 4** for descriptions and potential construction limitations by ecosite within WLNP.

*Ecological Integrity*
Ecological Integrity (EI) is defined in the Canada National Parks Act as “a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes”.

The indicators used to assess EI in WLNP include: native biodiversity; climate and atmosphere; aquatic ecosystems; terrestrial ecosystems; and landscapes. Two of the park's most distinctive characteristics, fescue grasslands and plant species diversity are on a declining trend due to continuing invasion of non-native species, and the encroachment of aspen into grassland habitats.

The state of EI in the park as assessed in the State of the Park Report (Parks Canada 2008) is summarized in Table 1.

Table 1 Condition of indicators used to determine the Ecological Integrity of WLNP

| **Ecological Integrity (EI)** | | |
|---|---|---|
| Native Biodiversity | ↔ | Native biodiversity is in good condition, with a stable trend. Ungulate, bird and Bolander's Quillwort populations are in good condition and stable. Wildlife mortality remains within acceptable levels. Sharp-tailed grouse numbers are naturally low and may be declining. Amphibians have declined but are stable. Information is unavailable for other measures |
| Climate & Atmosphere | ◆ | Rating is not assigned. There are no targets or thresholds and data are too short-term to indicate trends. It is unknown how and to what extent climate properties affect the EI of the various park ecosystems |
| Aquatic Ecosystems | ↓ | Aquatic ecosytems are in good condition but with a declining trend because of reduced water quantity and aging culverts which restrict movements of aquatic species. Bull trout redds are in good condition. Information is insufficient to report on trumpeter swans |
| Terrestrial Ecosystems | ↓ | Terrestrial ecosystems are in poor condition with a declining trend because of invasive plant species and pathogens. Rangeland exclosures indicate stable conditions |
| Landscapes | ↑ | Landscapes are in poor condition but with an improving trend. The park's fescue grasslands are shrinking because of aspen and shrub encroachment. The improving trend reflects the re-introduction of fire and the success of the Waterton Front project in protecting surrounding lands from subdivision and development. |

Source: Parks Canada 2008.

For a more detailed discussion of EI and its indicators for WLNP, refer to the State of the Park Report (2008).

*Species at Risk*

WLNP is host to a number of species that are Endangered, Threatened and Special Concern under Schedule 1 of the *Species at Risk Act* (SARA). Species listed as Endangered, Threatened and Special concern under COSEWIC, as well as the Alberta *Wildlife Act* are also considered in managing species at risk within WLNP. Defined and proposed critical habitat within WLNP is found in **Appendix 3** and other habitat association maps.

Table 2 Species at Risk Occurring in Waterton Lakes National Park

| Species | SARA status | COSEWIC | Provincial Status |
|---|---|---|---|
| **Vascular Plants** | | | |
| Bolander's Quillwort | Threatened | -- | -- |
| Limber Pine | -- | Endangered | Endangered |
| Whitebark Pine* | Endangered | -- | Endangered |
| **Arthropods** | | | |
| Half-moon Hairstreak* | Endangered | -- | -- |
| Western Bumble Bee | -- | Threatened (southern subspecies) | -- |
| **Amphibians** | | | |
| Long-toed Salamander | -- | Not at risk | Special Concern |
| Northern Leopard Frog | Special Concern (Western Boreal/Prairie Populations) | | Threatened |
| Western Tiger Salamander | -- | Special Concern (Prairie/Boreal Population) | -- |
| Western Toad | Special Concern (Calling and/or Non-calling populations) | -- | -- |
| **Reptiles** | | | |
| Western painted turtle | Special Concern | -- | -- |
| **Birds** | | | |
| Band-tailed Pigeon | Special Concern | -- | -- |
| Bank Swallow | -- | Threatened | -- |
| Barn Swallow | -- | Threatened | -- |
| Black Swift | -- | Endangered | -- |
| Bobolink | -- | Threatened | -- |
| Canada Warbler* | Threatened | -- | -- |
| Chestnut-collared Longspur* | Threatened | -- | -- |
| Common Nighthawk* | Threatened | -- | -- |
| Ferruginous Hawk* | Threatened | -- | Endangered |
| Harlequin Duck | -- | Not assessed | Special Concern |
| Horned Grebe | -- | Special Concern | -- |
| Lewis's Woodpecker* | Threatened | -- | -- |
| Loggerhead Shrike | Threatened | -- | Special Concern |
| Long-billed Curlew | Special Concern | -- | Special Concern |
| Olive-sided Flycatcher* | Threatened | -- | -- |
| Peregrine Falcon | Special Concern | -- | Threatened |
| Prairie Falcon | -- | Not assessed | Special Concern |
| Red-headed Woodpecker* | Threatened | -- | -- |
| Rusty Blackbird | Special Concern | -- | -- |
| Short-eared Owl | Special Concern | -- | -- |
| Sprague's Pipit | Threatened | -- | Special Concern |
| Trumpeter Swan | -- | Not at Risk | Special Concern |
| Western Grebe | -- | Special Concern | Threatened |
| Western Screech-Owl* | Endangered | -- | -- |
| White-winged Scoter | -- | Not assessed | Special Concern |
| Whooping Crane | Endangered | -- | -- |
| **Fish** | | | |
| Westslope Cutthroat Trout | Threatened | -- | Threatened |

| Species | SARA status | COSEWIC | Provincial Status |
|---|---|---|---|
| Bull Trout | -- | Threatened (Saskatchewan-Nelson Population) | Threatened |
| Pygmy Whitefish | -- | Not assessed | Threatened |
| **Mammals** | | | |
| American Badger | -- | Special Concern | Data Deficient |
| Grizzly Bear | -- | Special Concern (Western Population) | Threatened |
| Little Brown Myotis* | Endangered | -- | Data Deficient |
| Plains Bison | -- | Threatened | -- |
| Western Small-footed Myotis | -- | Not assessed | Special Concern |
| Wolverine | -- | Special Concern (Western Population) | Data Deficient |

*species with no published recovery strategy

## Components of the environment that may be affected

Potential effects from projects occurring within WLNP are well understood and predictable. They include:

Water Resources:

- Adverse modifications to surface drainage patterns
- Reduced water quality due to increased erosion, sedimentation, transportation of debris and contamination (i.e. from leaks and accidental spills, etc.)
- Physical alteration of aquatic habitat

Soil/Land Resources:

- Change in slopes, landforms and landscape
- Soil compaction and rutting
- Slope instability due to increased soil exposure and improper excavation and storage
- Soil contamination

Air quality:

- Decreased ambient air quality (i.e. from dust, equipment emissions, etc.)
- Increased ambient noise levels
- Temporary increased levels of CO2 and other pollutants
- Temporary increased localized temperatures from paving and equipment operation

Vegetation:

- Damage to and/or removal of vegetation in immediate or adjacent areas
- Introduction of non-native species populations, or expansion of existing populations

Wildlife:

- Introduction of non-native species populations, or expansion of existing populations
- Wildlife sensory disturbance causing displacement/preferred habitat avoidance
- Wildlife habituation/attraction to artificial food sources
- Impeded/altered wildlife movement
- Damage to nests/disruption of nesting animals
- Mortality from project activities
- Damage to the quality of nesting / spawning / roosting habitats

Cultural Resources:

- Adverse effects on the heritage value or character-defining elements of a cultural resource
- Impacts to archaeological resources (known or potential)

Visitor Experience / Safety

- Decreased quality of visitor experience due to temporary area closures, operation of equipment, sensory disturbance
- Potential impacts to visitor safety due to construction activities

# Mitigation Measures

To use the document efficiently, keep the activity mitigation lists that apply to the project expanded and collapse the other activities by clicking on the section titles, print this as a pdf or paper document and include with the EIA determination record. This will reduce the overall size and scope of the mitigations to present to contractors and project managers.

*Choose all that apply to project. Each title is hyperlinked to the related section.*

*Module*


1. ENVIRONMENTAL SURVEILLANCE
2. PROJECT PLANNING / DESIGN
3. SUBMISSIONS
4. ENVIRONMENTAL ALIGNMENT SHEETS
5. EROSION AND SEDIMENT CONTROL PLAN
6. EMERGENCY RESPONSE PLAN MODULE
7. GENERAL ACTIVITIES MITIGATIONS MODULE
8. VEGETATION REMOVAL MITIGATIONS MODULE
9. SOIL HANDLING MITIGATIONS MODULE
10. SOIL AND VEGETATION RESTORATION MITIGATIONS MODULE
11. SLOPE STABILIZATION, DRILLING AND BLASTING MITIGATIONS MODULE
12. ASPHALT PRODUCTION AND HANDLING MITIGATIONS MODULE
13. CONCRETE HANDLING MITIGATIONS MODULE
14. PAVING, RESURFACING, GRADING MITIGATIONS MODULE
15. DRAINAGE STRUCTURES MITIGATIONS MODULE
16. WORKS OVER OR IMMEDIATELY ADJACENT TO WATER
17. WATER WITHDRAWAL AND DEWATERING MITIGATIONS MODULE
18. BUILDINGS & STRUCTURES
19. GEOTECHNICAL
20. SERVICE LINE HDD
21. FIRE OPERATIONS

# 1. Environmental Surveillance

1.1. 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.

1.2. 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.

1.3. 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 the project EIA.

# 2. Project Planning / Design

Project planning and engineering design for new projects or upgrades to existing infrastructure will incorporate consideration of environmental impacts of long term operation and the potential for Conservation Gains through improved design.

## Lighting / Dark Sky Compliance

2.1. The replacement or installation of new lighting must be dark sky compliant and follow the Parks Canada Guidelines and Specifications for Outdoor Lighting (**Appendix 10**). Outdoor fixtures must be shielded, full cut off low intensity dark sky compliant lights. Interior lighting must be designed to reduce light trespass. The colour temperature of any new luminaires should be under 3000K, with amber LED or converted amber LED preferred.

## Wildlife Collisions & Direct Mortality

Buildings and structures may include features that attract or result in direct mortality of wildlife. For example, reflective or transparent surfaces and lights left on after dark can attract or confuse resident and migratory birds leading to an increase in collisions.

2.2. Incorporate lights that shut-off automatically to promote energy efficiency and reduce night time bird collisions.

2.3. Minimize use of unnecessary reflective or transparent materials in building design.

2.4. For windows, complete risk assessment for collisions and consider technologies that effectively make windows visible to birds (e.g., UV visible coatings, closely spaced marker dots).

2.5. Appropriately screen chimney and ventilation shafts to avoid attracting cavity roosting birds or bats to risky locations.

2.6. Appropriately screen all water intakes to prevent amphibian and fish mortality.

## Wildlife Habitat & Movements

2.7. Do not constrict wildlife movement corridors and wildlife trails with physical barriers or sensory disturbance (e.g., lighting, fences, generator noise, and increased human use). Known areas of constricted wildlife movement are outlined in **Appendix 7**.

2.8. In the Waterton community or areas with high visitation, do not create wildlife barriers where animals may become trapped or difficult for Wildlife Conflict Specialists to manage (e.g., fences, corners, spaces under decks).

2.9. Enclose all areas such as under porches, to prevent access by wildlife (*e.g.,* prevent cougars from using these areas for hunting, caching and resting).

2.10. For gated/fenced areas, provide escape routes such as leaving 45 cm clearance under gates.

2.11. Improve landscape connectivity for terrestrial and aquatic wildlife:

- Remove anthropogenic constrictions from wildlife movement corridors;
- Increase the span length of bridges during replacements to allow for terrestrial wildlife passage underneath; and
- Convert smaller culverts to larger culverts or clear span bridges to allow for better fish passage and less restricted flows (see **culvert section**).

## Human Use

2.12. Incorporate human behaviour into design to minimize human use impacts on the surrounding lands. Some examples include:

- Block social trails and provide clear wayfinding signage to encourage use of designated trails;
- Formalize a single trail to remove multiple social/unwanted trails;
- Prevent vehicle parking outside designated areas; and
- Manage wildlife attractants and litter through garbage facilities.

## Efficiency

2.13. Design includes materials and technologies that minimize environmental impacts through the lifecycle of the material.

2.14. Design incorporates energy efficiency, reduction of greenhouse gases and environmental design best management practices (e.g., LEED criteria).

2.15. Minimize water use and incorporate water meters in buildings over 1000 $m^2$.

## Project Footprint & Siting

2.16. Avoid sensitive features and apply appropriate setbacks.

2.17. The Project Footprint and construction methods use existing disturbances and development footprints as much as possible in order to minimize project impacts on native vegetation.

2.18. Minimize visual impact of site layout, access routes and construction activities.

2.19. Locations are compatible with any zoning requirements (e.g., avalanche paths, wilderness zone). See **Appendix 8**.

2.20. Design minimizes the area and/or impact of disturbance.

2.21. Design and plan activities and works near watercourses and waterbodies to minimize disturbance to aquatic habitat and avoid sensitive spawning habitats.

2.22. Design and construct approaches to a watercourse perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation.

2.23. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or the built structures.

## Aquatic Habitat / Water Quality

2.24. Minimize runoff into water bodies; direct runoff and storm water into vegetated areas rather than directly into surface waters.

2.25. Avoid designs and construction practices that result in long, smooth, uniform slopes and may contribute to erosion or sediment transfer.

2.26. Apply appropriate standards for all septic field, pit privy, and other waste water management at facilities.

2.27. Projects < 100 m from sensitive aquatic features including wetlands, drainages, streams, lakes and other surface water requires additional EIA to determine appropriate setbacks, mitigations and other design considerations related to aquatic habitats.

## Fire

2.28. Design considers location and materials appropriate for risk of fire, following FireSmart Canada guidelines where feasible to reduce risk of fire in the wildland-human interface.

## Restoration Funding / Plan

2.29. Project planning and design minimize the disturbance to surrounding vegetation as much as is feasible.

2.30. Project planning incorporates opportunities to restore or use existing disturbed areas. Consult the disturbed areas database in **Appendix 9**.

2.31. Project planning includes restoration of the site following construction. Short term revegetation must establish native vegetation cover to reduce potential for erosion, topsoil loss, and weed infiltration and spread. Long term restoration will establish native vegetation communities similar to existing communities prior to disturbance, or comparable to adjacent areas (see **Restoration Section**).

## Pre-Construction Surveys

2.32. Prior to the commencement of project activities, the IAO may determine that field surveys are required to determine the applicability of this BMP, requirements for additional impact analysis, identify sensitive features, and determine mitigations.

2.33. All ground disturbance activities must be compared to local archaeological resource inventories and the IAO will consult with the Terrestrial Archaeology section. An Archaeological Overview Assessment (AOA) may be required to determine the archaeological potential of the work area. Based on the results from the AOA, an Archaeological Impact Assessment (AIA) might be required.

| Survey | Required | Details |
|---|---|---|
| Phase I Environmental Site Assessment | ☐ | |
| Hazardous Materials Survey | ☐ | |
| Reconnaissance Site Visit | ☐ | |
| Rare Plant Survey | ☐ | |

| Survey | Required | Details |
|---|---|---|
| Wetland Survey | ☐ | |
| Wildlife Survey (list types) | ☐ | |
| Fish Assessment | ☐ | |
| Soils / Geotechnical | ☐ | |
| Cultural Resources (list type) | ☐ | |
| AOA / AIA | ☐ | |
| Water/Air Quality | ☐ | |
| Visitor Experience | ☐ | |
| Weed Survey | ☐ | |
| Other | ☐ | |

# 3. Submissions

3.1. Check box of attachments / plans required prior to the start of construction.

| Attachments / Plans | Required | Responsible Party | Reviewer and Submission Deadline |
|---|---|---|---|
| Environmental Alignment Sheets | ☐ | | |
| Erosion and Sediment Control Plan | ☒ | Prime Contractor | IAO; 3 weeks prior to start of construction |
| ERP (Emergency Response Plan) | ☒ | Prime Contractor | IAO; 3 weeks prior to start of construction |
| Spill Response Plan | ☒ | Prime Contractor | IAO; 3 weeks prior to start of construction |
| Fire Contingency Plan | ☐ | | |
| Avalanche Safety Plan | ☐ | | |
| Site-specific Mitigation Details | ☐ | | |
| Restoration Plan | ☒ | PCA (AECOM to provide planting plan for trees) | IAO; Prior to start of construction activities |
| HDD or Geotechnical Drill Plan | ☐ | | |

# 4. Environmental Alignment Sheets

4.1. Environmental Alignment Sheets (EAS) are maps of the project area that clearly outline environmental and cultural sensitivities relative to the designated work area. They assist the PM, SO and contractor in the scheduling, planning, and execution of Project works.

# 5. Erosion and Sediment Control Plan

5.1. An Erosion and Sediment Control Plan (ESCP) will be prepared that covers all construction and restoration periods.

5.2. The requirements for an erosion and sediment control plan can be scaled to the scope and associated risks of the project, as determined by the IAO or SO.

5.3. The Erosion and Sediment Management Plan will be developed by a qualified professional and is subject to approval of the IAO.

## Timing of Works

5.4. Schedule work to avoid extreme wet, windy and rainy periods that may increase erosion and sedimentation.

5.5. 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.

## General Mitigations

5.6. Erosion control measures that prevent sediment transport into any waterway, water body or wetland shall be implemented by the contractor.

5.7. 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).

5.8. Identify sources of potential runoff (e.g., ditches, slopes) from within the construction site or from upslope areas. Construct and maintain structures to deflect sources of runoff from entering areas of exposed soils (e.g., diversion ditches, vegetative filter strips).

5.9. Acquire necessary erosion and sediment control equipment (i.e., landscaping fabric, sediment fences, coir rolls etc.) and install prior to risk of sediment transport.

5.10. 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.

5.11. Plan project activities to minimize soil handling.

5.12. Limit equipment movement over exposed soils.

5.13. Avoid activities that contribute to soil compaction and use practices that roughen and decompact soils to promote infiltration.

5.14. Ensure all activities are conducted at least 30 m from waterbodies wherever possible.

5.15. Minimize extent of vegetation cover removal and grubbing. Clearly mark construction boundaries to prevent accidental damage to vegetation.

5.16. Where vegetation cannot be retained, apply soil covers to erodible areas (granular materials, mulches, tackifier, tarps). Note that tarp covers may not be suitable at most locations in WLNP where high winds are common.

5.17. Minimize the length of time soils are exposed and complete work in one area before commencing work in another area.

5.18. 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.

5.19. Initiate replanting of disturbed areas immediately after construction is completed.

5.20. Ensure all erosion and sediment control devices are weed free. Straw and hay based erosion control is not permitted.

5.21. Avoid use of coconut matting due to ungulate hoof entrapment.

5.22. 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.

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

5.24. 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.

### Minimum Requirements

5.25. The minimum requirements of an erosion and sediment control plan include consideration of:

- Project design and spatial concept of environmental sensitivities (e.g. watercourses, wetlands, steep slopes etc.);
- Erosion prevention procedures (e.g., project schedule, minimization of work area, site management, ground cover measures);
- Sediment control measures (e.g. sediment fences, check dams, sediment traps, etc.) including specifications and Typical Drawings of sediment control structures;
- Detailed plans for instream works including site isolation measures and project timelines;
- Water management plans including site control, equipment necessary and proposed dewatering locations;
- Locations of erosion and sediment control measure application;
- Monitoring of prevention and control measures and corrective actions (e.g., repairs).
- Removal of non-biodegradable materials once site is stabilized.

## 6. Emergency Response Plan Module

6.1. The general emergency contact for WLNP is Banff Dispatch (403) 859-2636.

### Spill Response Plan

6.2. 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 of the IAO.

6.3. 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).

6.4. 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*

6.5. Avoid work in high risk areas, particularly in areas of high water table, steep slopes or in close proximity to streams.

6.6. Have spill containment equipment on-hand and ensure that all personnel are aware of their location and trained in their use.

6.7. Absorbent booms must be immediately available on site during works in and near water.

6.8. Ensure all construction equipment is free of leaks from oil, fuel or hydraulic fuels. See **General Activities** module for the requirements for equipment inspection by the SO prior to entry to WLNP.

6.9. 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.

6.10. 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).
6.11. Hazardous or toxic products shall be stored no closer than 100 metres from streams, wetlands, water bodies or waterways.
6.12. Equipment will be fuelled on hardened surfaces wherever possible.
6.13. Spill kits shall be provided at re-fuelling, lubrication, and repair locations.
6.14. 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.
6.15. 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.
6.16. All gas generators and water pumps require secondary containment. Electric pumps are preferred.
6.17. Follow all applicable regulations and codes for the management and handling of hazardous waste.
6.18. 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 Parks Canada.
6.19. 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.
6.20. The SO shall be notified immediately of any spill. In the event of a major spill, Banff Dispatch (403-859-2636) shall be notified immediately.

A major spill is defined below:

| **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; Major Spill |
| 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.<br><br>> 100 L, immediately notify the SO and Banff Dispatch. | At the discretion of the SO. Major Spill if not contained.<br><br>Required; Major Spill |

*Minimum Requirements*

6.21. 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; and
- up-to-date emergency response contact list including contact information for reporting spills.

*Spill Reporting Requirements*

6.22. 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

## Fire Contingency Plan

6.23. 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 the IAO in consultation with the Fire Management Officer.

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

6.25. 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.

*6.26.* Where an emergency fire contingency plan has been requested, the prime contractor should provide, at minimum the required equipment as defined in Table "A" of the *Alberta Forest and Prairie Protection Regulations*.

6.27. 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.

Table 3 Adapted Alberta Forest and Prairie Fire Protection Regulations AR 135/72, Table "A"

| **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. |
| Back pack with pump | 0 | 0 | 1 | 2 | 3 | 5 | 10 | 15 | 20 | |
| Axe or Pulaski | 0 | 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 | |

### Avalanche Safety Plan

6.28. 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 completed.

6.29. 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.

6.30. If the avalanche safety plan is drafted by the Prime Contractor, it must be approved by Parks Canada Avalanche Forecasters.

6.31. The Prime Contractor can also choose to work under the Parks Canada Avalanche Safety Plan provided that this has been communicated to the WLNP Visitor Safety Technician and acknowledged in writing.

6.32. The Prime Contractor is responsible for ensuring and documenting that all crew members and sub-consultants have the required certification and training for work in avalanche terrain, as outlined in the Avalanche Safety Plan.

## 7. General Activities Mitigations Module

Construction activities involve the use of laydown/staging areas, equipment operations, storage and handling of hazardous materials. Potential adverse effects include: alteration of vegetation, erosion and sedimentation, constriction for wildlife movements and introduction/spread of non-native vegetation.

7.1. 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.

7.2. 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.

## Construction Timing / Visitor Experience

7.3. Confine construction activities to hours set below, and if possible to periods of low visitation in order to reduce sensory disturbance to wildlife and visitors.

7.4. Time activities to minimize vehicle conflicts on access roads (*i.e.,* where possible, schedule activities so that equipment operations does not disrupt traffic flow; result in wildlife collisions).

7.5. All Parks Canada designated speed limits apply to construction vehicles. Additional speed restrictions may be required to protect wildlife and visitor safety.

| | Required | Location(s) | Notes |
|---|---|---|---|
| Additional Speed Limits | ☐ | | |
| Work Hour Restriction | ☒ | | 0800-2000; As required by seasonal operations. |
| Designated Truck Routes | ☐ | | |

## Timing Windows

7.6. Timing windows to reduce erosion, maintain compliance with the *Migratory Birds Convention Act*, *Fisheries Act, Species at Risk Act* and may be part of best practices to reduce erosion and environmental effects. See detailed mitigations for timing windows under **Erosion and Sediment Control**, **Vegetation Removal** and **Buildings** modules where these activities are part of project works. A summary of these restrictions is made below.

| Consideration | Applicable | Restricted Window | Notes |
|---|---|---|---|
| Migratory Bird General Breeding Period | ☒ | April 1 to August 31 | |
| Bat Maternity Roost Activity Period | ☐ | April 1 to August 31 | |
| Bat General Activity Period | ☒ | April 1 to October 31 | If moving buildings within the restricted window, SO must complete bat building evaluation. |
| Amphibian Calling Window | ☐ | Consult IAO | |
| Bull Trout Restricted Work Periods | ☐ | August 31 to August 15 | |
| Other Fish Species Restricted Work Periods | ☐ | Consult IAO | |
| Grassland Dormancy | ☐ | October 1 to February 28 | |
| Additional Timing Considerations (e.g., weed seed set, soil protection) | ☒ | Consult IAO | Avoid construction when wet conditions may lead to compaction, rutting, or increased erosion and sedimentation risk. |

## Work Site Conditions/Staging/Laydown

7.7. Minimize vegetation-clearing activities and ground disturbance by staging on existing hardened areas wherever possible.

7.8. Delineate the work zone; clearly mark the limits to active construction, sensitive features and the access and egress locations.

7.9. The Prime Contractor is responsible for security and safety of the work site.

7.10. Strong winds are a regular occurrence in WLNP. Prevent materials from blowing off of work site.
7.11. If contamination is found, cease work immediately and if necessary, implement Emergency Response Plan.

## Wildlife Observations and Encounters

7.12. 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.
7.13. If wildlife is observed at or near the work site, allow the animal (s) the opportunity to leave the work area to the surrounding habitat and away from areas of potential conflict.
7.14. If potentially dangerous wildlife (e.g., bear, cougar, wolf, deer, sheep) persistently enter the work area or display aggressive behaviour, the contractor will immediately notify Banff Dispatch (403-859-2636), will stop work and safely evacuate the area.
7.15. Contractor will make bear spray, bear spray training, and wildlife awareness training mandatory to all workers on site.
7.16. Secure all materials that might attract wildlife (e.g. petroleum products, human food, recyclable food and drink containers and garbage).
7.17. 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.

## Equipment Operations & Fuelling

7.18. Equipment movements and workers' private vehicles shall be restricted to the designated footprint of the construction area.
7.19. Protective measures, including using appropriately sized equipment, or protective access matting must be employed if entry into wet areas is required.
7.20. Due to the importance of fescue grassland within WLNP, vehicles must not be driven onto any open grassland areas unless it has been designated by the SO as a parking area prior to construction activities.
7.21. 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).

| | **Required** | **Location(s)** | **Notes** |
|---|---|---|---|
| Are additional weed cleaning stations required? | ☒ | TBD | Additional weed cleaning stations may be required if materials are being stored off site, as determined by the SO. |

7.22. Inspect equipment daily for fluid/fuel leaks and maintain equipment in good working order.

7.23. 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.
7.24. Mobile fuel containers (e.g., slip tanks) shall remain in the service vehicle at all times.
7.25. 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.
7.26. Limit machinery crossing (fording) a stream or watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure in compliance with the *Fisheries Act*.
7.27. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
7.28. Use temporary crossing structures or other practices to cross streams or water bodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds.
7.29. Equipment that will work adjacent to or within a stream or watercourse should be free of external grease, oil or other fluids, excessive mud, dirt and vegetation before entering the work area.

### *Small Equipment*

7.30. All small equipment (e.g., chainsaws, mowers, etc.) should be kept in good working condition and free of oil and fuel leaks.
7.31. Where possible, chain oil should be vegetable-based.
7.32. Fuelling of chainsaws will take place outside of riparian areas and sensitive features.

## Site Clean Up/Waste Disposal

7.33. Clean tools and equipment at an appropriate off-site facility to prevent the release of wash water that may contain deleterious substances.
7.34. 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.
7.35. 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.
7.36. 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.
7.37. 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.
7.38. 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.

### Air Quality Mitigations

7.39. Diesel equipment used on the project shall be fuelled with low sulfur diesel fuels and shall conform to local emission requirements.
7.40. Minimize idling of engines at all times.
7.41. Schedule dust generating activities during periods with lower wind speeds.
7.42. Ensure fine materials being transported are covered and protected.

### Cultural Resources

7.43. 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. Parks Canada's Terrestrial Archaeology section will provide advice and assessment of significance and determine requirements to mitigate the chance find. Examples of archaeological artefacts encountered in WLNP include buried bison bones, stone tools, and above ground cairns.
7.44. If applicable, follow additional mitigations outlined in the Cultural Resources Impact Assessment.

| | Required | Location(s) | Notes |
|---|---|---|---|
| Are additional mitigations for cultural resources required? | ☒ | Kitchen Shelters | Must meet requirements outlined in CRIA including photo documentation. |

## 8. Vegetation Removal Mitigations Module

Project activities that may alter or remove vegetation include mowing, brushing, and landscape maintenance activities, non-native species management, fire hazard reduction and prescribed burn operations and pre-construction site clearing. Grubbing (stump and root removal) may be required to prepare the ground surface for other activities.

### Wildlife Timing Windows

All vegetation, including grassland, has the potential to provide habitat for wildlife. Applicable timing windows for individual project vegetation removal is listed under the **General Activities Mitigations Module**.

8.1. The regional bird/songbird nesting period in WLNP is **April 1 to August 31**. Avoid all vegetation removal during this time. If vegetation removal is scheduled to occur within this period, the SO may complete pre-work surveys for nesting migratory birds. See **Appendix 2** on regulatory guidance for further detail on the MBCA and SARA.

- Nesting surveys must be completed within 7 days of project activities.
- There is a **risk of delays** to project activities due to the presence of nesting migratory birds.
- If a nest is found during the pre-work surveys, the vegetated area will be left intact with a suitable sized protected buffer until the young have left the nest and vicinity. Size of buffer is species dependent, to be determined by the SO in consultation with federal regulatory guidance.

8.2. Vegetation clearing can negatively impact bats in spring and summer. The timing windows for avoidance of vegetation removal activities in WLNP is April 1 to August 31 for vegetation likely to support roosting bats. If vegetation removal is scheduled to occur within this period, the SO may complete pre-work surveys for bat roosts.

- Roosting surveys must be completed within 7 days of project activities.
- There is a **risk of delays** to project activities due to the presence of bat roosts.
- If a potential bat roost is located, a site-specific mitigation strategy must be developed dependent on the type of roost and species present, to be determined by the SO in consultation with federal regulatory guidance.

8.3. Vegetation removal can negatively impact amphibians and reptiles, especially during breeding, transformation and important movement periods within and close to wetlands.

- If vegetation removal is to occur within 300 m from a confirmed or potential amphibian breeding wetland, or within 500 m from a confirmed SAR amphibian breeding wetland, additional impact analysis is required and site-specific mitigations developed.
- If vegetation removal is scheduled to occur during non-frozen conditions, the SO may complete an amphibian and reptile ground search immediately prior to equipment activities.
- If ground disturbance activities are scheduled to occur in frozen conditions, amphibian exclusion fencing may be required in the preceding fall season at the discretion of the SO.

## Other Timing Considerations

8.4. Where ground disturbance accompanies vegetation removal, time activities to minimize soil handling, soil compaction, and erosion potential. Avoid extreme dry windy and wet conditions.

8.5. In areas with weed infestations, reduce weed spread through vegetation removal prior to seed set.

## Vegetation Removal Mitigations

8.6. If previously unidentified sensitive features are found during construction, immediately stop work and notify the SO (e.g., raptor nest).

8.7. 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.).

8.8. Minimize full removal and retain vegetation when possible to reduce erosion.

8.9. Retain 30 metre vegetated buffer around sensitive features; where disturbance is unavoidable < 30 metres, a restoration plan is required and the SO must be on site during disturbance activities.

8.10. Do not deposit debris in water bodies.

8.11. Limbing must be completed using the appropriate equipment to minimize damage to the tree (i.e., using a hoe bucket to limb trees is not appropriate as it can cause the bark to tear and can make the remaining tree vulnerable to diseases and rot).

*Tree removal*

8.12. Safety of workers and the public is the first priority for all tree removal operations. In consultation with the SO, felling of snags or hazard trees outside the designated work area may be permitted, where required for safety of fellers.

8.13. Unless approved by the SO due to site-specific limitations be felled away from sensitive features, such as watercourses, wetlands, riparian zones, or ecological features.

8.14. Ensure tree limbs/stumps are flush cut as close to the ground or stem as possible.

8.15. Fallers should assess each tree individually for critical wildlife features such as nests or cavities. Notify the SO if unexpected features are identified.

8.16. Mechanical falling can be used where it is determined that machines will cause minimal site degradation, due to suitable soil conditions, or on a site that is to be developed for future access or facilities.

8.17. Mechanical falling may be preferable on sites with numerous hazard trees to be retained for their habitat values, or where mechanical falling equipment can be used to minimise soil disturbance and better direct fallen trees away from environmentally sensitive areas.

8.18. Logs and other salvage materials are to be conveyed to and placed at a 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.

8.19. 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.

8.20. Where possible, preserve identified wildlife trees by limbing or topping if they are not assessed as hazard trees.

## Disposal of Vegetation Debris

8.21. Where practicable, as much of the coarse woody debris and organic matter from the tree removal should remain on the site and used in restoration. The quantity and distribution of slash remaining must not impede wildlife movement, choke out native vegetation, create a significant fire hazard or cause an excessive nutrient flush.

8.22. All debris that is not being disposed of on-site must be removed as soon as possible from the project footprint, by transporting off-site for disposal.

8.23. If temporary storage is required, store debris on already disturbed areas to minimize footprint of disturbance.

8.24. All vegetation containing non-native species will be bagged and removed off site to disposal facility.

8.25. On approval of the SO, vegetation debris may be taken to the WLNP burn pile at the upper government compound provided all materials are transported, placed and sorted according to current WLNP requirements.

8.26. If removal is not feasible a chipper may be used for less than 50 boles per hectare. Chip depth is to be a maximum of 5 cm (2 inches), spread over area no greater of 5m x 5m per hectare so as to not cover underlying vegetation, prevent new native seedlings from sprouting, and cause soil/seed bank sterilization. Spreading of chips may extend beyond these parameters with approval by the SO.

8.27. Firewood must be salvaged and bucked and stacked at the government compound.
   - Firewood Tree: one that has a minimum diameter off 15 cm outside bark at stump height (30 cm) and a usable length of 4.88 m to a 10 cm diameter (inside bark).

- Fire Piece: One that is 2.44 m (plus 5 cm trim allowance) or longer, with a 10 cm (inside bark) small end, where rot content or form does not render it unusable.

### Pile Burning (PCA Prescribed Burn Operations)

### Herbicide Use

8.34. A Field Unit Integrated Pest Management Plan (IPMP) must be completed and approved prior to the use of herbicides to ensure the most effective and least harmful substances are properly used.

# 9. Soil Handling Mitigations Module

To successfully complete restoration of disturbed areas, and protect areas from erosion, proper soil handling and backfilling procedures must be followed. Post excavation and stripping soil and vegetation restoration mitigations should be applied. See Section 10 of this BMP for **Soil and Vegetation Restoration**.

9.1. All soil handling activities require consideration of erosion and sediment control. **See ESCP Section**.

### Soil Stripping

9.2. No stripping shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest.

9.3. Stripping close to any watercourse, water body or wetland shall employ methods to ensure materials are not pushed, do not fall or erode into the water or wetlands.

9.4. Soil must be stripped in accordance with the **ESCP**. Key components for soil stripping are:

- Minimize soil movement and handling at all times.
- 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.

### Topsoil Salvage

9.5. Salvage topsoil at all excavation sites for restoration purposes.

9.6. Prevent loss of topsoil through wind or water erosion.

9.7. 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.

9.8. 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.

9.9. 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.

*Fescue Grassland*

### Excavation

9.17. All trenches or ditches left unattended overnight must be fenced or covered to prevent wildlife entrapment or provide appropriate egress for wildlife.

9.18. 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.
9.19. 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.
9.20. Special precautions may have to be taken during excavation in the vicinity of intermittent or active drainage channels.
9.21. Minimize changes to the ground surface that affects its infiltration and runoff characteristics and maintain/re-establish effective surface drainage on completion of the project.
9.22. Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation.
9.23. To limit over compaction, use equipment which minimizes surface disturbance including low ground pressure tracks/tires, blade shoes and brush rake attachments.
9.24. All excavations will remain free of water (see **dewatering mitigations**).

### Excavated Material Storage

9.25. 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.
9.26. Topsoil from separate ecotypes or areas of the project may not be mixed without approval of the SO (i.e., grassland soils must be kept separate from forested soils).
9.27. 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.
9.28. 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.
9.29. Construct barricades to prevent losses on steep terrain (>18°, 3:1).

### Excess Materials and Waste (Overburden Removal)

9.30. 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.
9.31. Surplus excavated material may be used to fill depressions around the project site providing topsoil is stripped before filling, with approval from SO.

## 10. Soil and Vegetation Restoration Mitigations Module

Almost all projects activities included in this BMP will require some ecological restoration- *the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed*. The restoration plan can be a simple application of the following mitigations and can be at the site or both at the site and in concert with another site designated to offset the permanent impact of a project. A restoration plan is required for all projects but the scale and scope can be adapted to that required by the project (i.e., BMPs, site restoration plan, etc.). Restoration works can often be considered projects in and of themselves. Soil and vegetation restoration must apply the principles of effective, efficient and engaging solutions.

## Restoration Plan

10.1. Develop restoration plan as part of the project scoping and specifications prior to project approvals.
10.2. Ensure that the appropriate restoration materials are available as needed immediately following construction activities.
10.3. The restoration plan will be subject to the approval of the IAO, who will be responsible for consulting with the Park Vegetation Ecologist.
10.4. The restoration plan should the following minimum information

- Site description;
- Site-specific restoration goals and objectives;
- Schedule of clean-up activities;
- Timing of restoration activities;
- Restoration Standards; and
- Follow-up Protocols (i.e., supplemental seeding, native transplants, weed control, etc.)

## Timing Windows

10.5. Complete initial seeding as soon as possible.
10.6. Supplemental planting should be timed for the species and location. Seeding in the fall allows for full scarification of the seed over the winter. Consider using seed that requires shorter scarification times for spring and summer applications. Transplants may do best in the spring and summer and can require watering or other maintenance.
10.7. Time weed control measures to prevent seed propagation.

## Topsoil Replacement

10.8. Implement restoration plan for the disturbed area immediately following completion of construction.
10.9. Minimize soil movement and handling to protect existing native seed bank.
10.10. Replace topsoil to all areas immediately following fine grading.
10.11. Do not compact topsoil.
10.12. Backfilling should allow settling to prevent depressions however, long term roach piles on linear disturbances should be minimal.
10.13. 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 Park Vegetation Ecologist. Methods of improving vegetation succession using locally sourced, weed and contaminant free materials are preferred.
10.14. Slopes to be seeded should be no steeper than 2 horizontal to 1 vertical (2:1) and covered with a minimum of 5 cm (2 inch) of topsoil. Finish grading should always follow top soil placement. Maintain structure (i.e., rocks, roots, woody debris) in topsoil.
10.15. Where remaining soils are unstable due to steepness or soil characteristics, immediate installation of sod or other erosion control is required.
10.16. Methods of bioengineering such as terracing, willow staking, live pole drain systems should be assessed as solutions where soils are steeper or remain unstable.

*Fescue Grassland*

## Soil Amendments

*Fertilizer Application*

10.24. Avoid use of fertilizer to limit non-native vegetation growth and allow for local species to use available nutrients.

10.25. If needed use locally sourced mycorrhizae compost teas to improve vegetative success, as approved by WLNP vegetation ecologist.

*Topsoil substitute*

10.26. Apply an organic cellulose only amendment as a soil substitute if restoration standards are not being met within the defined time frame.

10.27. Determine the type of organic amendment based on the site-specific requirements (e.g., peat moss, compost) at the discretion of WLNP vegetation ecologist.

## Seedbed Preparation

10.28. The seedbed will be scarified by hand or, with the approval of the SO, by machine on large areas (i.e., roadbeds) where it is accessible and appropriate.

10.29. The seedbed will be scarified if seeding takes place more than 7 days after final grading or if there has been a rainfall between final grading and the seeding date.

10.30. The cleats of a tracked vehicle or a harrow device will be used, where possible, to prepare an adequate seedbed with seedling safe-sites (microsites) substantially free of soil crusts.

10.31. Align cleat marks at right angles on slopes to trap seed and sediment and reduce erosion.

## Species Selection

10.32. When selecting species and varieties:

- Use species of local native plant communities.
- Avoid use of cultivars.
- Species viability in proposed environment and climatic conditions.
- Capability to effectively control erosion, where required.
- Adaptation to the variable site conditions of undulating topography.
- Consider palatability of some species to herbivores and avoid growing attractants in areas of increased risk to wildlife and visitors.
- Variable life expectancy to produce variable, delayed die-out of seeded species and replacement with indigenous native plants.

## Seed Mix Selection

10.33. Prescriptive seed mixes are provided in **Appendix 5**. If an appropriate seed mix is not available, the SO will contact the Park Vegetation Ecologist to determine an appropriate mix for the Project.

10.34. Percentage of individual species within mixes are approximate and may vary depending on seed availability. A number of native species that are available only in limited quantities commercially have been included in the seed mixes. These seed mixes are to be used conditional on availability of individual species; modifications/replacements are allowed, subject to approval by the WLNP Vegetation Ecologist.

10.35. Prior to seed purchase, certificates of seed analysis will be provided to the Vegetation Ecologist for approval.

- Do **NOT** purchase seed until written approval is obtained.
- Certificates of Analysis must include both the common and include the scientific name following the CANADENSYS nomenclature system; indicate if the seed is a cultivar, ecovar, or wild native; geographic origin (seed source); date of collection; method of seed storage; germination, viability and vigour; and indicate all other species occurring including agronomic, weed, and native species; and date of the analysis. The contact information for the Seed Supplier will be included.

10.36. All seed is subject to testing by PCA prior to use.

### Seeding

10.37. Use only seed purchased after written approval is obtained.
10.38. Seed and stabilize (e.g. mulch/tackifier) bare areas as soon as possible after disturbance, preferably as soon as a significant area is graded and finished and before the next rain event. If there is a risk of seedling mortality as a result of fall frost stabilize until appropriate growing conditions exist.
10.39. In previously disturbed lawn areas of the Waterton Community, consider using sod in high traffic areas or places that need extra erosion control.
10.40. Use temporary seeding when outside the seeding dates for permanent vegetation.
10.41. Apply a seed mixture which is appropriate for the climate, soil, and drainage conditions of the site.
10.42. Apply seed at a rate appropriate to the seed mixture, seeding method and existing vegetation conditions.
10.43. Conduct broadcast seeding under calm wind conditions. Hydro-seeding is acceptable where access is available.
10.44. Do not increase the seeding rate to compensate for poor seedbed conditions.
10.45. Monitor temporary erosion control measures to prevent seed loss.
10.46. Supplemental seeding may be required in subsequent years.

### Alternatives to Seeding

10.47. Use topsoil seed bank in small areas when there is no risk of erosion or competition from invasive species (i.e., natural regeneration).
10.48. Use native transplants in areas where conventional seeding applications are not applicable or where slope stability is an issue.
10.49. Use native transplants to provide additional diversity and structure to supplement seeding.
10.50. Use conventional forestry planting methods for container grown transplants, see **website** for guidance.

## 11. Slope Stabilization, Drilling and Blasting Mitigations Module

## 12. Asphalt Production and Handling Mitigations Module

Asphalt is a common building material for transportation infrastructure. Its production requires the use of gravel, water, and petroleum products, and associated project activities include

transportation, storage and handling of these materials. Installation of asphalt plants is common within the larger parks where gravel extraction is undertaken.

## Timing of Works

12.1. Asphalt works are preferably undertaken during periods of dry weather as this allows easier control of contaminated runoff and sediment.

12.2. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

## Gravel Crushing and Washing

12.3. Where possible within engineering constraints, asphalt materials should be recycled to reduce the need for new gravel.

12.4. Gravel will be obtained from an approved operational borrow pit only. For gravel obtained from a borrow pit within a protected heritage place or borrow pit, gravel extraction within the footprint of the disturbed area of the approved operational borrow pit is permitted.

12.5. Gravel will not be crushed within 30 meters of any water body.

12.6. If water for cleaning is extracted from a watercourse, refer to **water withdrawal section** of this BMP.

12.7. If gravel requires washing, the water used will not be returned directly to any watercourse.

12.8. Water free from chemical contaminants will be discharged into ground where further erosion and runoff into surface water is prevented. Discharging into well vegetated ground surface, at a rate which prevents erosion can often provide increased absorption and reduction of sediment load.

12.9. Contaminated water must be treated to meet CCME guidelines or transported outside of WLNP for disposal at an approved facility.

12.10. For waste removed from WLNP a detailed receipt of delivery to an approved facility will be provided to the SO.

## Oiling of Truck Boxes

Trucks for hauling asphalt mixture shall have tight, clean, smooth metal beds that have been sprayed with a minimum amount of thin fuel oil to prevent the mixture from adhering and causing waste asphalt.

12.11. Truck boxes may be oiled only when absolutely necessary.

12.12. Oiling will take place in a bermed area, consisting of a plastic underlay with 15 centimetres overlay of clean gravel. Oil contaminated gravel will be hand collected (so as to prevent tearing of the plastic) from the bermed area daily, and put through the asphalt plant.

12.13. Vehicle covers shall be securely fastened.

## Disposal and Clean Up of Other Waste Products

12.14. To ensure regular clean-up of waste asphalt and petroleum spills, a defined clean up schedule will be established during the preconstruction meeting.

12.15. Leaks will be collected in drip-trays, the collected material will either be removed from WLNP, or recycled back through the Asphalt Plant. For any material removed outside WLNP to an approved facility, a detailed receipt will be provided to the ESO.
12.16. Used oil, filters, grease cartridges, oil cans and other waste products of plant servicing will be collected and disposed of at the nearest industrial waste facility.

# 13. Concrete Handling Mitigations Module

Concrete is a common construction material. Its use ensures longevity of the infrastructure and safety for public use. One litre of concrete wash water or leachate in 1000L of water will kill fish. Cement-based products including grouts and concrete are lethal to fish and many other aquatic organisms. Raw product or leachate entering a watercourse will alter water chemistry, making it more basic or alkaline.

## Onsite Temporary Concrete Washout Facility

13.1. Temporary concrete washout facilities shall be located a minimum of 100 m from storm drain inlets, open drainage facilities, and watercourses.
13.2. Temporary concrete washout facilities shall be temporary pit or bermed areas constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
13.3. Wood stakes, and sandbag materials can be used to construct temporary containment walls or “barriers”.
13.4. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.
13.5. The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.
13.6. Washout of concrete mixer trucks is not permitted in WLNP.
13.7. Wash concrete from mixer truck chutes/pumps into approved concrete washout facility or collect in an impermeable bag for disposal.
13.8. Pump excess concrete in concrete pump bin back into concrete mixer truck.
13.9. Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed offsite.
13.10. Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of per federal and provincial regulations.

## Maintenance and Inspection of Temporary Concrete Washout Facilities

13.11. Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 100 mm (4 inches) for above grade facilities and 300 mm (12 inches) for below grade facilities.
13.12. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.
13.13. Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
13.14. Temporary concrete washout facilities shall be inspected for damage (i.e. tears in PVC liner, missing sand bags, etc.).

13.15. Onsite concrete waste storage and disposal procedures should be monitored at least weekly or as directed by the SO.

### Removal of Temporary Concrete Washout Facilities

13.16. Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and restored.

### Onsite Concrete Management

13.17. Rolling concrete mixers with surplus concrete in amounts less than one cubic metre of wet concrete may waste this concrete in a right-of-way as directed by the SO in areas that drain well away from watercourses. Surplus amounts in excess of one cubic metre are to be returned to the batching yard.

13.18. Water contaminated in the placing of cement and curing of concrete shall be contained and removed from the site to an approved disposal facility.

13.19. The concrete batching plant must be operated pursuant to applicable dust, air emission, and water quality control regulations.

13.20. Waste, solidified concrete from rolling concrete mixers in amounts less than 1 cubic meter and waste solidified concrete from construction pour shall be buried in the grade within 48 hours of the pour, or removed from the site subject to approval and direction from the SO.

## 14. Paving, Resurfacing, Grading Mitigations Module

Surface management activities are undertaken to ensure public safety on PCA surfaces by maintaining clean, level, and unbroken road surface conditions through activities such as pavement cleaning, patching, application of surface treatments, and pavement crack sealing. Grading is used to address drainage issues, vegetation encroachment, potholes and rough surfaces.

### Timing of Works

14.1. Works are preferably undertaken during periods of dry weather (e.g., summer) as this allows easier control of contaminated runoff and sediment.

14.2. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

### Grading

14.3. During grade construction conducted close to any watercourse, water body or wetland ensure materials are not pushed, fall or are eroded into the water or wetlands.

14.4. No grade building shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.

14.5. Materials shall be placed at storage sites or on the grade without spillage outside the work limits. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.

14.6. Retain a 30 metre vegetated buffer around water bodies or install runoff management structures.
14.7. If possible, grade roads early in the spring before vegetation develops seed heads or late in season after vegetation has set seed and is dormant to minimize non-native vegetation propagation.
14.8. Ensure gravel or road bed material is free of weeds and comes from an approved operational gravel source free of other contaminates.

### Paving and Resurfacing

14.9. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface waters.
14.10. Minimize application of seal coats in wet conditions. Attempt to apply only to dry surfaces and not prior to (within 24 hrs.) or during rainfall. If unforeseen rain arrives ensure runoff from recently seal coated surfaces are prevented from entering surface waters.
14.11. For asphalt handling and management see the **Asphalt Mitigation Module** of the BMP.

### Pavement Marking and Barrier and Guardrail Reinstatement

14.12. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface water Pavement marking shall be undertaken pursuant to standard methods applied in National Parks for control of paint products, both in transport and handling. The Contractor shall present a description of methods to be employed for transporting and controlling paint and hazardous products, application of paint, cleaning of equipment, containment and disposal of waste paint and cleaning products, etc. to the satisfaction of the SO.
14.13. Where concrete barriers or guard rails are temporarily removed, for highway improvements, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

## 15. Drainage Structures Mitigations Module

## 16. Works Over or Immediately Adjacent to Water

Works over or immediately adjacent to water include activities associated with the maintenance and repair of bridge structures and/or viewing platforms located adjacent to water. Activities could include the cleaning and painting of structures as well as the repair, rehabilitation, and replacement of elements including decks, railings, abutments, and bearings. Works may include asphalt, concrete works, chipping, painting, grouting, timber truss, abutment and piling maintenance. These activities help ensure bridge structures remain structurally sound and safe for public use.

### Timing of Works

16.1. Bridges provide nesting and roosting habitat for wildlife including Cliff Swallows and Little Brown Bats. See timing windows under the **General Activities Mitigations**

**Module**. If work must occur in the restricted timing window, the SO may complete preconstruction surveys to determine if activities may proceed.

- There is risk of **DELAY** to project activities if work is scheduled within the migratory bird window.

16.2. Time work in water to respect **timing windows** to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed.

- Detailed information on timing windows and their application in WLNP is included in **Appendix 12.**

16.3. Conduct in-stream work during periods of low flow to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.

16.4. If the work schedule requires working in the rain, the area of work must be isolated with appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

## Bridge Cleaning

16.5. Schedule bridge-cleaning activities to coincide with the watercourse's spring freshet when possible. At freshet or during periods of high flow a large watercourse will often have its highest background levels of sediment. At this time, the introduction of a small amount of sediment to a watercourse (from bridge cleaning) will have a lower risk of potential impact when considered against those high natural background levels.

16.6. If works are planned outside the freshet or if your region does not experience a freshet, discuss the protocol and timing of these works with your local aquatics ecologist and/or DFO Officer.

16.7. Dry sweep and collect loose material off bridge surfaces before washing the bridge. Adequately seal drains and any open joints on the bridge deck before sweeping or washing to prevent material or sediment-laden wash water from entering any watercourse.

16.8. If dry sweeping and preventing direct runoff to waterway is not a feasible way to clean the surface, discussion and planning with local aquatic ecologists will be required.

16.9. Use water alone. If your cleaning activities require degreasers or any other chemical, approval for use must be obtained from local aquatics specialists and/or DFO.

16.10. Contain any wash water or runoff to the bridge deck. Direct wash water towards the bridge approaches and away from the watercourse, then to a vegetated area or contained settling area (e.g., dry ditch channel unconnected to a watercourse) where it can infiltrate.

16.11. If superstructure cleaning is undertaken above or on the bridge deck level, prevent potentially harmful materials from entering into road drains. Block deck drains with suitable barriers (e.g., polyethylene or drain blocks) to prevent direct discharge to a watercourse, or re-route runoff through temporary piping onto adjacent containment structure.

16.12. Hydrovac or vacuum trucks may be an option to assist in containment of wash water.

16.13. If water for cleaning is extracted from a watercourse, refer to **water withdrawal section** of this BMP.

### Repairs Using Treated Wood Products

16.14. Untreated wood products are recommended, if treated wood is to be used, ensure it has been treated with a wood preservative appropriate for the project. Refer to the ***Parks Canada Guide for the Use, Handling and Disposal of Pressure Treated Wood 2009*** and any further updates from **Parks Canada Real Property – Environmental Management**.

16.15. If treated timber must be cut to size, ensure cutting takes place away from the bridge and watercourse. Sawdust from treated wood is harmful to aquatic organisms and must be prevented from entering any watercourse.

16.16. Wood preservatives should be applied in a contained area and not be applied over or within 200m of water.

### Bridge and Structure Painting

16.17. Ensure paint flakes, abrasive grits and abrasive/paint flake mixtures do not enter the watercourse as they may leach toxic heavy metals into receiving waters and/or be ingested by fish.

16.18. Install ground covers and/or vertical drapes such as sheets of plastic or air-permeable cloth (e.g., burlap or canvas) prior to removal activities to capture falling debris. Floating barges may be deployed in watercourses to capture falling debris, such as paint flakes and dust.

16.19. Waste materials collected during removal and application of protective coating operations (e.g., blasting abrasives, paint particles, rust and grease) should be collected and retained for disposal at appropriate locations. Waste materials must not be deposited into watercourses or riparian areas.

16.20. Use hydro blasting or manual techniques, where possible, when removing road dirt, soluble salts and loose paint to minimize impacts to the watercourse.

16.21. Use water without cleaning agent additives if grease film removal is necessary.

16.22. Avoid use of toxic liquid paints, primers, solvents, degreasers and rust inhibitors.

16.23. Minimize spill potential by storing, mixing and transferring paints and solvents on land.

## 17. Water Withdrawal and Dewatering Mitigations Module

Construction often requires the use of water; many common methods of excavation and site isolation require dewatering. Temporary, short term water withdrawal provides an efficient uncontaminated water source for local project sites. Dewatering can allow sites to be effectively dry during construction, reducing the impact of sediment laden water entering fish bearing waters.

### Additional Permits

17.1. All water withdrawal requires a Restricted Activity Permit issued by the IAO.

### Equipment Cleaning

17.2. All hoses, pumps, intake hoses, or equipment from outside of WLNP must be clean and dry on arrival and require approval and inspection by the SO prior to use in WLNP (see **General Activities Section**).

17.3. Do not bring equipment into WLNP from areas that have known infestations of aquatic invasives (e.g., USA, east of Saskatchewan).

17.4. Thoroughly clean water trucks, hoses, pumps and intake hoses using clean HOT WATER with as much pressure as possible.
17.5. If last use of equipment was out of province, allow hoses, pumps and intake hoses to dry completely and then remain dry (ideally for >20 days).

## Timing Windows

17.6. As a general guide to prevent taking more water than aquatic system can support, limit total take of water to less than 5 successive days and less than 10 days in any period of 30 days.
17.7. Do not withdraw water from waterbodies that support breeding amphibians.

## Water Withdrawal

17.8. Water should not be withdrawn from a wetland or stream less than 2 metres wide at the surface or a lake less than one hectare in area.
17.9. Water withdrawal should follow the 10/90 rule which allows for up to 10% of the stream flow to be withdrawn, as long as the stream flow does not fall below the 90% exceedence flow (eg.1 in 10 chance in a given year).
17.10. No permanent or semi-permanent works for water withdrawal should be placed in the stream channel.
17.11. Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish, amphibians and/or reptiles. Entrainment occurs when a fish or amphibian is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish, reptile or amphibian is held in contact with the intake screen and is unable to free itself.

## Pump Screens

17.12. Fish-bearing waters design and installation of intake end-of-pipe fish screens:

- Locate screen in areas and depths of water with low concentrations of fish throughout the year away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
- Orient the screen face in the same direction as the flow of water.
- Ensure openings in the guides and seals are less than the opening criteria to make “fish tight”.
- Screens should be located a minimum of 300 mm (12 in.) above the bottom of the watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.
- Provide structural support to the screen panels to prevent sagging and collapse of the screen. Large cylindrical and box type screens should have a manifold installed to ensure even water velocity distribution across the screen surface. The end of the structure should be made of solid materials and the end of the manifold capped.
- Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where debris loading (woody material, leaves, algae mats, etc.) is a concern. A 150 mm (6 in.) spacing between bars is typical.
- Provision should be made for the removal, inspection, and cleaning of screens.
- Ensure regular maintenance and repair of cleaning apparatus, seals, and screens to prevent debris fouling and impingement of fish.

- Pumps must be shut down when fish screens are removed for inspection and cleaning.

### Dewatering

17.13. A site specific dewatering plan is required be provided before commencing a pump-out sump to dewater excavation sites with specific details on how and where the water will be discharge.

17.14. Site specific mitigations may be required depending on the conditions of the discharge area, freezing conditions operation, overflow avoidance, decanting and settlement pond restoration.

17.15. Water containing suspended materials shall not be pumped into watercourses, drainage systems or on to land, except with the permission of the SO.

17.16. Soil and vegetation erosion protection is required for water pumped on to land.

## 18. Buildings & Structures

*These mitigations are currently in development. Consult with the IA Office for more information.*

### General Activities

18.1. As appropriate for project activities, a Phase I Environmental Site Assessment and/or hazardous material survey must be completed by qualified personnel. Mitigations to safely and effectively manage any impacts of hazardous materials on people or the environment will require additional project planning (e.g., asbestos, ground contamination).

18.2. If building systems will incorporate glycol or antifreeze, ensure design includes containment and spill response plan. If risk to aquatic habitat cannot be mitigated, use alternative system.

18.3. Refer to **Section 2, Project Planning and Design** for addition mitigations related to building design.

18.4. Be aware that high winds are common in WLNP and all materials need to be secured to prevent materials from blowing off site, particularly during high risk activities such as roofing.

### Wildlife & Structures - Bats

Resident bats in southwest Alberta include Little Brown Myotis (*Myotis lucifugus*), an Endangered species on Schedule 1 of the *Species at Risk Act* (SARA) that is often associated with buildings. Project proposals that include building renovation, refurbishment, relocation, and demolition have the potential for adverse effects on this listed species of risk.

18.5. Buildings require a Bat Building Evaluation to determine the potential use at the building (i.e., none, day roost, night roost, maternity roost, or hibernacula). Results of the evaluations are used to determine the appropriate site-specific mitigations and prevent any residual effects of Project activities on Little Brown Myotis or other bat species.

18.6. Identify adjacent natural or artificial roosts that can be avoided or maintained during the Project.

18.7. Reduce light trespass from buildings and in natural areas or corridors bats may use to travel from roosts to water (see **Section 2, Project Planning and Design**).

18.8. Maintain the properties and characteristics of a structure that make it attractive to bats and where feasible, allow them to continue roosting at the structure. Where not feasible, a site specific mitigation plan is required.

18.9. Structures and buildings provide nesting and roosting habitat for wildlife including Cliff Swallows and Little Brown Bats. See timing windows under the **General Activities Mitigations Module**. If work must occur in the restricted timing window, the SO may complete preconstruction surveys to determine if activities may proceed.

- There is risk of **DELAY** to project activities if work is scheduled within restricted windows.

### Sandblasting, Painting, Stripping

18.10. Minimize sandblasting to only remove loose paint and provide a clean surface for new paint to adhere to.

18.11. Confine activity to days with little or no wind and use physical barriers to contain dust.

18.12. See the section on **Spill Response** for spill response.

### Ground Thawing

18.13. If ground must be thawed to allow excavation, activities related to generators, fuel stations, and antifreeze/glycol must be included in Spill Response Plans.

### Foundation

18.14. See Section 13, **Concrete Handling**.

## 19. Geotechnical

## 20. Service Line HDD

## 21. Fire Operations

# References and Source Documents

Axys Environmental Consulting Ltd. and David Walker & Associates. 1998. Best Available Methods for Common Leaseholder Activities. 2013. Prepared January 1998 and updated March 2013 for Line Leaseholders Working Group, Jasper National Park.

British Columbia Ministry of Transportation and Infrastructure. 2010. Environmental best practices for highway maintenance activities 2nd ed. Government of British Columbia.

British Columbia Ministry of Forests and Environment Lands and Parks. 2000. Provincial Wildlife Tree Policy and Management Recommendations. Government of British Columbia.

Coordinated Technology Implementation Program. 2011. Current and Innovative Solutions to Roadside Revegetation Using Native Plants. Federal Highway AdministrationU.S. Department of Transportation. http://www.nativerevegetation.org/pdf/B1422_Roadside_revegetation_Report_complete.pdf

Dane, C. 1978 Culvert Guidelines: Recommendations for the Design and Installation of Culverts in British Columbia to Avoid Conflict with Anadromous Fish. Fisheries and Marine Service Technical Report No.811. Department of Fisheries and Environment. Government of Canada.

Dick, Robert. 2008. Guidelines for Outdoor Lighting in Dark Sky Preserves. Royal Astronomical Society of Canada

Dick, Robert. 2014. Report on Current Lighting within Waterton Lakes National Park, Specifically the Town Site of Waterton. Report presented to Parks Canada.

Environmental Protection Agency Office of Water. 2000. A Guideline for Maintenance and Service of Unpaved Roads. Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority. http://water.epa.gov/polwaste/nps/urban/upload/2003_07_03_NPS_unpavedroads_ch5.pdf

Fisheries and Oceans Canada. Measures to Avoid Harm. Accessed February 2015. http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html

Fisheries and Oceans Canada. Self-Assessment Criteria. Accessed February 2015. http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html

Federal Highway Administration. 2011. Clear Zones and Roadside Terrain. United States Department of Transportation. http://safety.fhwa.dot.gov/roadway_dept/clear_zones/cmclearzones/

Government of British Columbia. 1996. Water Act and Water Regulation. Crown Publications, Queens Printer.

Lausen, C. 2012. Waterton Lakes National Park Bat Survey. Birchdale Ecological Ltd. Kaslo, B.C.

Parks Canada. 2007. Parks Canada Omnibus Environmental Protection Plan Mitigation Measures. Government of Canada.

Parks Canada. 2007. Parks Canada Best Management Practices for Fire Management Operations. Government of Canada.

Parks Canada. 2008. Guidelines and Specifications for Outdoor Lighting at Parks Canada. Real Property and Ecological Integrity Branches of Parks Canada.

Parks Canada. 2008b. Waterton Lakes National Park of Canada: State of the Park Report. Government of Canada.

Parks Canada. 2011. Waterton Lakes National Park of Canada Road Maintenance Guidelines. Government of Canada.

Parks Canada. 2012. Minor Repairs to Transportation Infrastructure in Atlantic Canada National Parks Replacement Class Screening Report. Government of Canada.

Parks Canada. 2012. Replacement Class Screening Report for Routine In-Water Works Projects Along the Rideau Canal and the Trent-Severn Waterway.

Parks Canada. 2015. Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure. Government of Canada.

Parks Canada. 2013. Flood 2013 Rehabilitation. Government of Canada

Parks Canada. 2013. Best Management Practice for Roadside Vegetation Maintenance at Point Pelee National Park. Government of Canada.

Parks Canada. 2013 Assessment of Highway Nighttime Paving. Jasper National Park, Government of Canada.

Parks Canada. 2013. Best Management Practice for Routine Vegetation Trimming and Clearing Pukaskwa National Park. Government of Canada.

Parks Canada. 2014. Highway Service Centre Engineering's Environmental Procedures. Jasper National Park, Government of Canada.

Parks Canada. 2015. Parks Canada Directive on Impact Assessment. Government of Canada.

Parks Canada. 2015. Basic Impact Analysis Rock Slope Remediation. Kootenay National Park, B.C. Government of Canada.

Parks Canada. 2015. Memo: Managing Risk of Invasive Mussels through Fire Operations. Government of Canada.

Parks Canada. No Date. Jasper Mitigation Manual. Government of Canada.

Transport Canada. 2008. Replacement Class Screening Report for Minor Transportation Repairs. June 2008. TC Contract # 8080-07-0061.

United Nations Food and Agriculture Organization.1998 Manual for the Planning, Design and Construction of Forest Roads in Steep Terrain. http://www.fao.org/docrep/w8297e/w8297e00.htm

# Appendix 1 Contact Information

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# Appendix 2 Regulatory Guidance

## Jurisdictions

While all projects on lands managed by Parks Canada must adhere to Federal law and regulation, it is considered best practice to refer to local community, regional, provincial regulation and best practices where federal guidance is silent and/or attempt to meet those targets if it can reduce the overall impact of the project.

Some of the project activities reviewed have potential environmental impacts that are addressed by various provincial, federal and territorial acts and regulations. All activities must meet current environmental law and regulations in their design and construction. The following is a brief description of some of the key federal acts and regulations. Further review, understanding and application of other federal, provincial and territorial environmental laws are part of a rigorous approach to project planning and execution.

## *Canada National Parks Act* and Regulations-Parks Canada

All work inside National Parks and Protected Areas must be performed in accordance with the laws and regulations set out in the *Canada National Parks Act* and Regulations. This includes the requirement for most activities described to only be done under a permit such as: business licence for contractor, disturbance of natural objects, travel in restricted areas, special events or use of disposal sites.

## *Fisheries Act* - Fisheries and Oceans Canada

If a project is to be conducted near water, it is the proponent's responsibility to ensure they avoid causing **serious harm to fish** in compliance with the ***Fisheries Act***. The **advice in on the Fisheries and Oceans website** will help a proponent avoid causing harm and comply with the Act.

If the water body in the project area has fish or is connected to waters at any time that have fish the project must meet the **self-assessment criteria on the Fisheries and Oceans website**, if not a project review can be made by Fisheries and Oceans Canada to assess whether the project requires authorization or authorization can be requested directly. Given the level of detail required for a review and/or authorization request the EIA officer may need to consider a more involved EIA pathway in those circumstances.

## *Migratory Bird Convention Act* – Environment Canada

The purpose of this Act is to implement the Convention by protecting and conserving migratory birds - as populations and individual birds - and their nests. Section 6 - prohibits the disturbance, destruction, or taking of a nest, egg, or nest shelter of a migratory bird.

In Canada, the general nesting period may start as early as mid-March and may extend until end of August. This is a general nesting period that covers most federally protected migratory bird species. This period varies regionally across Canada mainly due to differences in species assemblages, climate, elevation and habitat type. Generally, the nesting period is delayed in more northerly latitudes, corresponding to vegetation development and food availability. (Environment Canada, 2014). To help with determining regionally relevant periods where nesting is likely to occur, Environment Canada is publishing estimated regional nesting periods within large geographical areas across Canada referred as "nesting zones". These periods are estimated for each zone and consider the time of first egg-laying until the young have naturally

left the vicinity of the nest. Field Units may wish to refine this section and add their known local nesting periods.

### *Species at Risk Act*

If a species listed under the *Species at Risk Act* (SARA) is found within the project area, any potential adverse effects from the proposed project to the individuals of the species, their residences and/or their critical habitat must be understood. Species at risk considerations require specific expertise, due to additional legal requirements under the SARA and CEAA 2012. If the projects or activities to be addressed by the BMP could affect a listed species or its critical habitat, the EIA officer may need to consider a more involved EIA pathway in those circumstances.

# Appendix 3 Species at Risk Critical Habitat

*This section is in development. Contact the Impact Assessment Office for more information.*

Defined critical habitat maps exist exists for Bolander's Quillwort and Half-moon Hairstreak.

Contact the Impact Assessment Office for more information, including information regarding other habitats important for species at risk, as well as species at risk without defined critical habitat maps to date.

# Appendix 4 Ecosites of Waterton

*This section is in development. Contact the Impact Assessment Office for more information.*

# Appendix 5 Recommended Seed Mixes for WLNP

*This section is in development. Consult with Vegetation Ecologist prior to use of these mixes*

All commercial seed lots will have Certificates of Analysis for weed and undesirable species content and germination tests for each lot of each species in the mix. Certificates of Analysis for all seed lots must be made available to the WLNP Vegetation Ecologist prior to seed purchase. Any lot with unacceptable weed contamination, viability or species variety will be rejected.

Percentage of individual species within mixes are approximate and may vary depending on seed availability. A number of native species that are available only in limited quantities commercially have been included in the seed mixes. These seed mixes are to be used as possible conditional on availability of individual species; modifications/replacements are allowed, subject to approval by the WLNP Vegetation Ecologist.

Native seed mixes will be seeded within the appropriate areas of WLNP (*i.e.,* open fescue prairie, open deciduous forests with or without a mesic area modifier, etc.).

Inclusion of a clean cover crop (e.g., awned wheatgrass), to combat invasive plant problems may be considered.

| **Seed Mix** | **Species** | **Species % by Seed Weight** |
|---|---|---|
| Open Fescue Grassland Mix Rate = 40 kg/ha | Foothills rough fescue (*Festuca campestris)* | 40 |
| | Idaho fescue (*Festuca idahoensis*) | 20 |
| | Parry Oatgrass (*Danthonia parryi*) | 10 |
| | Bluebunch wheatgrass (*Agropyron spicatum*) | 10 |
| | June grass (*Koeleria macrantha*) | 7 |
| | Alkaline bluegrass (*Poa juncifolia*) | 3 |
| | Rocky Mountain fescue (*Festuca saximontana*) | 3 |
| | Sticky Purple Geranium (*Geranium viscosissimum*) | 3 |
| | Early Yellow Locoweed (Oxytropis sericea) | 3 |
| | Yarrow (*Achillea millefolium*) | 1 |
| **Aspen / Shrub Community Mix** Rate = 40 kg/ha<br><br>[1] species for dry open stands<br>[2] species for wet or closed stands | Smooth wild rye (Elymus glaucus) [1] | 25 |
| | Bluebunch wheatgrass (*Agropyron spicatum*) [1] | 20 |
| | Foothills rough fescue (*Festuca campestris)* [1] | 20 |
| | Idaho fescue (*Festuca idahoensis*) [1] | 15 |
| | Mountain Brome (*Bromus carinatus*) [1&2] | 10 |
| | Marsh Reed Grass (*Calamagrostis canadensis*) | 40 |
| | Tufted hair grass (*Deschampsia caespitosa*) [2] | 40 |
| | Sticky Purple Geranium (*Geranium viscosissimum*) | 2 |
| | Northern bedstraw (*Galium boreale*) | 2 |
| | Meadow Rue (*Thalictrum occidentale*) | 2 |
| | American vetch (*Vicia americana*) | 2 |
| | wild strawberry (*Fragaria virginiana*) | 2 |

# Appendix 6 List of Non-Native Species of Local Concern

*This section is in development and information provided may be incomplete. Contact the Impact Assessment Office for more information.*

Table 4 Non-native Species Listed by the *Alberta Weed Control Act*

| Common Name | Scientific Name |
|---|---|
| ***Prohibited Noxious*** | |
| autumn olive | *Elaeagnus umbellata* Thunb. |
| balsam, Himalayan | *Impatiens glandulifera* Royle |
| barberry, common | *Berberis vulgaris* L. |
| bartsia, red | *Odontites vernus* (Bellardi) Dumort |
| buckthorn, common | *Rhamnus cathartica* L. |
| cinquefoil, sulphur | *Potentilla recta* L. |
| crupina, common | *Crupina vulgaris* Pers. ex Cass. |
| dyer's woad | *Isatis tinctoria* L. |
| Eurasian water milfoil | *Myriophyllum spicatum* L. |
| flowering rush | *Butomus umbellatus* L. |
| garlic mustard | *Alliaria petiolata* (M. Bieb.) Cavara & Grande |
| goatgrass, jointed | *Aegilops cylindrica* Host |
| hawkweed, meadow | *Hieracium caespitosum* Dumort. |
| hawkweed, mouse-ear | *Hieracium pilosella* L. |
| hawkweed, orange | *Hieracium aurantiacum* L. |
| hoary alyssum | *Berteroa incana* (L.) DC. |
| hogweed, giant | *Heracleum mantegazzianum* Sommier & Levier |
| iris, pale yellow | *Iris pseudacorus* L. |
| knapweed, bighead | *Centaurea macrocephala* Puschk. ex Willd. |
| knapweed, black | *Centaurea nigra* L. |
| knapweed, brown | *Centaurea jacea* L. |
| knapweed, diffuse | *Centaurea diffusa* Lam. |
| knapweed, hybrid | *Centaurea × psammogena* Gáyer |
| knapweed, meadow | *Centaurea × moncktonii* C. E. Britton |
| knapweed, Russian | *Rhaponticum repens* (L.) Hidalgo |
| knapweed, spotted | *Centaurea stoebe* L. ssp. *Micranthos* (Gugler) Hayek |
| knapweed, squarrose | *Centaurea virgata* Lam. ssp. s*quarrosa* (Willd.) Gugler |
| knotweed, giant | *Fallopia sachalinensis* (F. Schmidt Petrop.) Ronse Decr. |
| knotweed, hybrid Japanese | *Fallopia × bohemica* (Chrtek & Chrtková) J. P. Bailey |
| knotweed, Japanese | *Fallopia japonica* (Houtt.) Ronse Decr. |
| loosestrife, purple | *Lythrum salicaria* L. |
| medusahead | *Taeniatherum caput-medusae* (L.) Nevski |
| nutsedge, yellow | *Cyperus esculentus* L. |
| puncturevine | *Tribulus terrestris* L. |
| ragwort, tansy | *Jacobaea vulgaris* Gaertn. |
| rush skeletonweed | *Chondrilla juncea* L. |
| saltcedar | *Tamarix ramosissima* Ledeb. |
| saltlover | *Halogeton glomeratus* (M. Bieb.) C.A. Mey. |
| St John's-wort, common | *Hypericum perforatum* L. |
| starthistle, yellow | *Centaurea solstitialis* L. |
| tamarisk, Chinese | *Tamarix chinensis* Lour. |
| tamarisk, smallflower | *Tamarix parviflora* DC. |
| thistle, marsh | *Cirsium palustre* (L.) Scop. |

| Common Name | Scientific Name |
|---|---|
| thistle, nodding | *Carduus nutans* L. |
| thistle, plumeless | *Carduus acanthoides* L. |
| ***Noxious*** | |
| baby's-breath, common | *Gypsophila paniculata* L. |
| bellflower, creeping | *Campanula rapunculoides* L. |
| bindweed, field | *Convolvulus arvensis* L. |
| blueweed | *Echium vulgare* L. |
| brome, downy | *Bromus tectorum* L. |
| brome, Japanese | *Bromus japonicus* Thunb. |
| burdock, great | *Arctium lappa* L. |
| burdock, lesser | *Arctium minus* (Hill) Bernh. |
| burdock, woolly | *Arctium tomentosum* Mill. |
| buttercup, tall | *Ranunculus acris* L. |
| chamomile, scentless | *Tripleurospermum inodorum* (L.) Sch. Bip. |
| clematis, yellow | *Clematis tangutica* (Maxim.) Korsh. |
| cockle, white | *Silene latifolia* Poir. ssp. *alba* (Miller) Greuter & Burdet |
| daisy, oxeye | *Leucanthemum vulgare* Lam. |
| dame's rocket | *Hesperis matronalis* L. |
| henbane, black | *Hyoscyamus niger* L. |
| hoary cress, globe-podded | *Lepidium appelianum* Al-Shehbaz |
| hoary cress, heart-podded | *Lepidium draba* L. |
| hoary cress, lens-podded | *Lepidium chalepense* L. |
| hound's-tongue | *Cynoglossum officinale* L. |
| mullein, common | *Verbascum thapsus* L. |
| pepper-grass, broad-leaved | *Lepidium latifolium* L. |
| scabious, field | *Knautia arvensis* (L.) Coult. |
| sow thistle, perennial | *Sonchus arvensis* L. |
| spurge, leafy | *Euphorbia esula* L. |
| tansy, common | *Tanacetum vulgare* L. |
| thistle, Canada | *Cirsium arvense* (L.) Scop. |
| toadflax, Dalmatian | *Linaria dalmatica* (L.) Mill. |
| toadflax, yellow | *Linaria vulgaris* Mill. |

Table 5 List of non-native species of local concern considered invasive in natural habitats.

| Common Name | Scientific Name |
|---|---|
| | |
| | |
| | |
| | |
| | |

# Appendix 7 Terrestrial Corridor Mapping

*This section is in development and information provided is incomplete. Contact the Impact Assessment Office for more information.*

WLNP is in the process of identifying key corridor locations. For EIA purposes, corridors will be identified as (1) constricted, (2) priority, or (3) caution. Information and analysis is currently incomplete, however as it becomes available, can be added to BMP.

Zone: Constricted
Identifies important wildlife movement areas that are already known to be significantly constricted by people and infrastructure and natural features and project design should aim to reduce constriction pressure.

- *i.e.,* Prince of Wales hill, corridor around area near emerald bay behind the superintendents house, area above Cameron Falls, Visitor Reception Centre, lower Government Compound, etc.

## Zone: Priority

Identifies important wildlife movement areas that are not currently known to be constricted by humans but constricted by human or landscape features and project design should proceed cautiously, reducing constriction pressure where possible.

- *i.e.,* the Dardanelles, west interface of Waterton Townsite, etc.

## Zone: Caution

Identifies general areas of wildlife movement where detailed, site-specific analysis should be undertaken.

- *i.e.,* Red Rock and Akamina valleys

## Lower Government Compound Area - Constricted

Unrestricted wildlife movement through the Waterton Valley is vital to maintaining local and transboundary wildlife populations in the area of Waterton Lakes National Park (WLNP). This major valley is especially important because of its interface between highly productive, low-elevation grasslands and remote, montane and subalpine habitats. The valley's north-south orientation with several adjoining east-west valleys is also of value to healthy wildlife populations. It is essential for movement of wildlife populations among high quality habitats in Alberta, British Columbia, and Montana. It is also an important link between several *Grizzly Bear Secure Areas* (GBSA) within WLNP. These are areas of high value habitat, minimal human use and sufficient size to support grizzly bears.

The existing lower government compound is located within an area of naturally constricted wildlife movement between the steep slopes of Crandell Mountain and Middle Waterton Lake. This corridor (Crandell Mountain-Middle Waterton Lake corridor) is approximately 330 m wide and is the best option for wildlife to move north-south through the west side of the Waterton Valley (versus via Crandell Mountain itself).

The presence of the existing lower compound, parkway and Kootenai Brown multi-use trail further restrict wildlife movement through this natural pinch point to two narrow areas on the

west side of the compound (narrowest undisturbed area approximately 30 m wide) and along the Middle Waterton Lake shore (undisturbed area = approximately 5 m wide on average - for several weeks per year this movement area is entirely eliminated by high water). Thus, approximately 11% of the width of the Crandell Mountain-Middle Waterton Lake corridor can be considered somewhat passable to wildlife.

To move in any direction through the Crandell Mountain-Middle Waterton Lake corridor, a key point in the valley, wildlife must navigate a high traffic parkway, a day use area, several high use human trails and the government compound, as well as the natural barriers. Preliminary remote camera data indicate that the majority of wildlife use may be concentrated along the west side of the compound, however the Middle Waterton Lake shore is also a key movement corridor. It's effectiveness has been reduced in recent years by removal of trees between the lakeshore and parkway to reduce snow drifting on the parkway.

When conservative disturbance buffers that are well accepted in scientific literature are considered, they virtually eliminate the suitable area for effective wildlife movement through the narrow Crandell Mountain-Middle Waterton Lake corridor. According to recent remote wildlife camera data, several wildlife species are indeed making use of the corridor, but in conservative volumes. For some of the more sensitive species such as grizzly bear, movement through the area might be considered at the cusp of being eliminated by any further disturbance or development; less sensitive species would likely be impacted negatively as well. Current levels of wildlife movement that is taking place can potentially be maintained by not expanding development in the area and improved by restoring key portions of the existing footprint.

If the consultant has any additional questions about this corridor, we could put them directly in touch with Kim Pearson, who is leading the study of wildlife movement through this area, but she will require additional time to provide more specific information.

Additional sensory disturbance including traffic, vehicles, people, noise, lighting etc. adjacent to a wildlife movement corridor can reduce its function. To some extent, these disturbances already exist at the compound, so depending on design, may not be significant effects. Analysis should consider:

- cumulative effects of additional disturbance with other existing activities at the compound (for example, helicopters during busy fire season),
- changes in the extent, location, and pattern of sensory disturbance (for example, current activities occur primarily during office hours, and visitor pressure may potentially extend into the evening)
- loss of natural area in relation to access and egress of wildlife to the known corridor

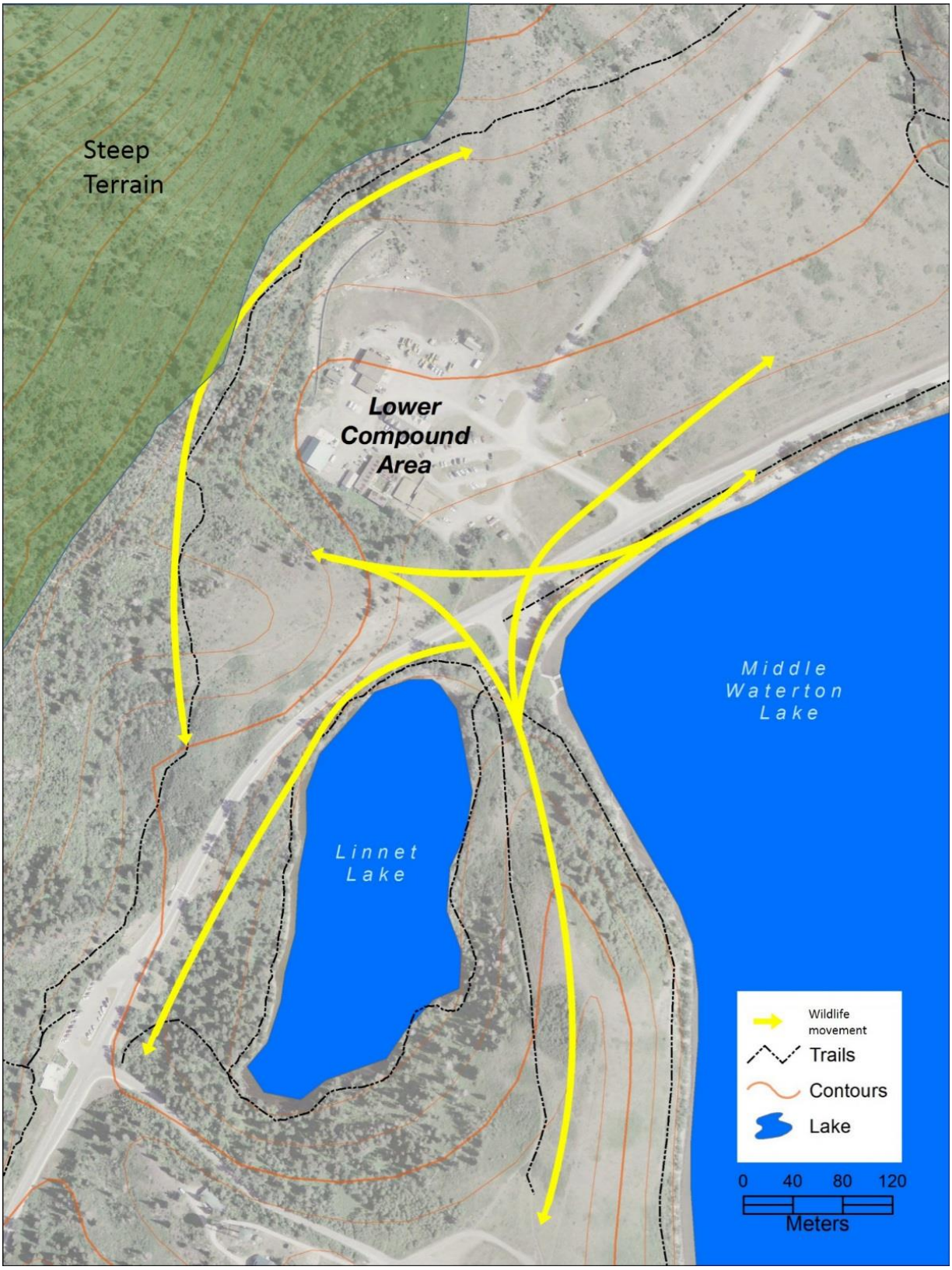



*Figure 1: Lower Compound - Middle Waterton Lake Corridor*

# Appendix 8 Zoning

*This section is in development. Contact the Impact Assessment Office for more information.*

Resources:

**Community Districts**

Waterton Land Use Districts in the Community (Environmental Reserve, Recreational Reserve, Commercial Retail, Commercial Accommodation, Institutional, Campground, Parking, Cottage)

Community Plan **G:\Common\Planning\CommunityPlan\Community Plan 2000**

**Avalanche Zones**

Alpine Solutions. 2015. Avalanche hazard zone mapping for Waterton townsite and parks compound. Report presented to Parks Canada. Available at **G:\Resource Conservation\Visitor Safety\AVALANCHE\Avalanche Mapping**

**Declared Wilderness Area**

General Information **G:\Common\Planning\Declared Wilderness Areas**

Park Management Plan **G:\Common\Planning\Park Management Plan**

# Appendix 9 Disturbed Area Database

*This section is in development. Contact the Impact Assessment Office for more information.*

# Appendix 10 Lighting / Dark Sky Compliance Guidelines

The replacement or installation of new lighting must be dark sky compliant and follow the Parks Canada Guidelines and Specifications for Outdoor Lighting Outdoor fixtures must be shielded, full cut off low intensity dark sky compliant lights. Interior lighting must be designed to reduce light trespass. The colour temperature of any new luminaires should be under 3000K, with amber LED or converted amber LED preferred.

Resources available at: **G:\Electronic Bookshelf\Park Management\Dark Sky**

Dick, Robert. 2008. Guidelines for Outdoor Lighting in Dark Sky Preserves. Royal Astronomical Society of Canada

Dick, Robert. 2014. Report on Current Lighting within Waterton Lakes National Park, Specifically the Town Site of Waterton. Report presented to Parks Canada.

Parks Canada. 2008. Guidelines and Specifications for Outdoor Lighting at Parks Canada. Real Property and Ecological Integrity Branches of Parks Canada.

# Appendix 11 Drawings

*This section is in development. Contact the Impact Assessment Office for more information.*

# Appendix 12 Details on Timing Windows

*This section is in development. Contact the Impact Assessment Office for more information.*

# Appendix B

## Hazardous Materials Assessment for Building Removals

ALBERTA SAFETY & ENVIRONMENTAL SERVICES

June 19, 2017

Kurt Gibb
AECOM
48 Quarry Park Boulevard SE, Suite 300
Calgary, Alberta T2C 5P2

Dear Mr. Gibb,

**Re: Pre-Demolition Hazardous Materials Assessment**
**Waterton Lakes National Park of Canada**
**Townsite Campground – Washroom #26, Electrical Building #22 and Storage Shed**
**200 Vimy Avenue, Waterton, Alberta**
**Project #: AS 8390**

## 1.0 INTRODUCTION

Alberta Safety & Environmental Services Ltd. (ASE Services) was requested by Kurt Gibb of AECOM to conduct a Pre-Demolition Hazardous Materials Assessment of Washroom #26, Electrical Building #22 and a Storage Shed located on the Waterton Lakes National Park of Canada Townsite Campground. This site is situated at 200 Vimy Avenue in Waterton, Alberta. The assessment was performed on June 02, 2017 by Grace-Ann Palmer with ASE Services.

The purpose of the assessment was to conduct a room-by-room survey to sample and/or identify building materials that may contain asbestos, lead and mould, as well as to identify the presence of other potential hazardous materials, such as polychlorinated biphenyls (PCBs), mercury, miscellaneous chemicals, radioactive material and ozone-depleting substances (ODS), in relation to the Alberta Occupational Health and Safety Act, Regulation and adopted Code, and industry-accepted guidelines. The results of the assessment have been used to complete a detailed inventory so that hazardous materials will be properly identified for appropriate management by the owners of the buildings prior to demolition.

## 2.0 SCOPE OF WORK

The scope of work involved an assessment of the building environment for the presence of building materials that may contain the following:

- Asbestos;
- Lead;
- Mould growth and/or water damage;
- Polychlorinated biphenyls (PCB's);
- Mercury;
- Miscellaneous Chemicals;
- Radioactive Materials; and
- Ozone-depleting substances (ODS).

The reporting scope of work for the building environment includes:

- Photographs of identified materials;
- Site drawings outlining the location of all identified hazardous materials; and
- Preparation of this report detailing our findings, conclusions and recommendations.

## 3.0 OBSERVATIONS

At the time of the assessment, ASE Services made the following observations and/or notes:

**Washroom #26**

- The year in which the building was originally constructed is unknown;
- All fixtures and plumbing had been removed from the building and the areas utilized for storage;
- The building was a one storey structure with a hip roof;
- The exterior siding, trim, windows and roofing materials were relatively new. They were recently replaced within the past 10 years as per information provided by the Parks Canada representative on site;
- The interior walls and ceiling consisted of painted particle board panels, with the exception of a four foot section north of the partition wall, where the particle board panels had been removed, exposing the wooden framing members; and
- The floor consisted of unfinished concrete with a relatively small section of leveling compound on the north side of the partition wall by the doorway.

**Electrical Building #22**

- The year in which the building was originally constructed is unknown;
- All electrical components within the building were active;
- The building was a one storey structure with a flat roof;
- The exterior siding and trim were relatively new. They were recently replaced within the past 10 years as per information provided by the Parks Canada representative on site;
- The exterior walls consisted of cinderblock. Intrusive investigation of the wall cavities revealed that no vermiculite insulation was present (see Photograph 01 in ***Appendix II***); and
- The ceiling and floor consisted of unfinished concrete.

**Storage Shed**

- The building was located west of Campsite #6 in Loop C;
- The year in which the building was originally constructed is unknown;
- The building was utilized for storage of grounds maintenance equipment among other items;
- The building was a one storey structure with an open gable roof;
- The exterior siding, trim, windows, side entry door and roofing materials were relatively new. They were recently replaced within the past 10 years as per information provided by the Parks Canada representative on site;
- The interior walls and ceiling consisted of exposing wooden framing members; and
- The floor consisted of unfinished concrete.

## 4.0 METHODOLOGY

The assessment included a room-by-room inspection of all accessible locations within the buildings, as well as an inspection of the exterior of the buildings. Samples of suspected asbestos-containing materials and suspected lead-containing materials were collected from the interior and exterior of the buildings. Where mould growth was suspected, a bulk sample was collected. Observations were made for water damage, PCBs, mercury, miscellaneous chemicals, radioactive materials, and ozone-depleting substances in the buildings. The methodology used for each parameter of the hazardous materials survey is outlined below.

## 4.1 Asbestos-Containing Materials

Small, representative pieces of those materials suspected to contain asbestos were collected and placed in clear, sealable plastic bags. The samples were forwarded to Crisp Analytical Laboratories, L.L.C. in Carrollton, Texas, and analyzed using the EPA 600/R-93/116 analysis method. This is a comprehensive method outlining various techniques for determining the asbestos concentration in bulk building materials.

## 4.2 Lead-Based Paint and Other Lead Materials

### 4.2.1 X-Ray Fluorescence (XRF) Testing

In-situ sampling of paint from painted surfaces, and other materials suspected to be lead-containing was conducted on site in accordance with ASTM E2119-00 Standard Practice for Quality Systems for Conducting In Situ Measurements of Lead Content in Paint or Other Coatings Using Field-Portable X-Ray Fluorescence (XRF) Devices, and the inspection protocols outlined in the U.S. Department of Housing and Urban Development's (HUD's) *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* (2012)[1]. Readings collected from the device were recorded in mass of lead per unit area (milligrams of lead per centimeter squared or $mg/cm^2$). Coating surfaces which yield inconclusive results were sampled for further analysis.

### 4.2.2 Lead Paint Bulk Sample Collection and Analysis

Small representative samples of paint were collected and placed in clear, sealable plastic bags. The samples were forwarded to iATL International Asbestos Testing Laboratories in Mt. Laurel, New Jersey for analysis. The samples were analyzed using the ASTM D3335-85A "Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectrophotometry" analysis method.

## 4.3 Visible Mould and Water Damage

ASE Services conducted a visual inspection of accessible areas for water damage and potential mould growth. The purpose of this investigation was to visually assess the extent of mould damage present (if any), and to determine the necessary actions for proper removal or cleaning, where required. It did not include the investigation of sealed wall cavities, additional ceiling spaces, or any other inaccessible areas at the time of the assessment. If areas were identified to have potential mould growth, a bulk sample was taken. Mould bulk sampling was performed by taking small, representative samples of those materials suspected to contain mould, and then placing them on glass slides. All samples were analyzed by certified ASE Services analysts.

## 4.4 Polychlorinated Biphenyls (PCBs) in Fluorescent Light Fixtures

Building materials were visually assessed for the presence, or potential presence of PCBs. Common building materials that may contain PCBs are fluorescent light ballasts, electrical transformers, and heat transfer equipment. Ballasts were considered inaccessible if the light fixture was not de-energized and the power locked out in accordance with the Alberta Occupational Health and Safety Act. Ballasts inaccessible at the time of assessment, are considered to be PCB-containing until proven otherwise.

## 4.5 Mercury in Thermostats and Pressure-Sensing Devices

All thermostats and pressure-sensing devices were visually assessed for the presence of a mercury-containing bulb. All fluorescent light tubes and compact fluorescent bulbs are known to contain mercury dust unless otherwise stated by the manufacturer. The presence of any of these items was documented.

[1] U.S. Department of Housing and Urban Development (HUD). *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* (2012).

### 4.6 Miscellaneous Chemicals

At the time of assessment, each room/area was inspected for the presence of miscellaneous chemicals such as paints, lubricants, oils, gasoline, and household and/or commercial cleaning products that may be impacted by the demolition and potentially pose an environmental hazard. The presence of any miscellaneous chemicals was documented.

### 4.7 Radioactive Materials

Ionization chambers in select smoke detectors contain a small amount of radioactive material to sense the presence of airborne particles or smoke. Self-powered EXIT emergency signs also contain radioactive material. Any smoke detectors and EXIT emergency signs that were inaccessible at the time of assessment for thorough visual inspections are considered to contain radioactive material until proven otherwise.

### 4.8 Ozone-Depleting Substances (ODS)

At the time of assessment, each room was visually inspected for equipment such as refrigerators, freezers and air conditioning units that may contain ODS. ODS contain the following chemical compounds:

- Chlorofluorocarbons (CFCs);
- Halons;
- Hydrochlorofluorocarbons (HCFCs);
- Bromochloromethane;
- Carbon Tetrachloride;
- Methyl Bromide; and
- Methyl Chloroform.

Stamp codes on the equipment indicate the type of chemical used in each piece of equipment. If stamp codes are not visible at the time of assessment the equipment is considered to contain ODS until proven otherwise. Please note that even equipment that uses ozone friendly chemicals must be removed, handled and disposed of and/or recycled properly as they could emit greenhouse gases.

## 5.0 RESULTS AND DISCUSSION

### 5.1 Samples Collected for Asbestos Content

Table 1 summarizes the laboratory sample results and provides an indication of the asbestos-containing materials present in the building(s). **Results indicate that one (1) sample was positive for asbestos.** Please refer to ***Appendix II*** for photographs, ***Appendix III*** for sample locations and ***Appendix IV*** for the laboratory report.

**Table 1: Summary of Asbestos Sample Analysis dated June 19, 2017**

| Sample # | Sample Location | | Sample Description | Type of Asbestos | Asbestos % | Photograph # |
|---|---|---|---|---|---|---|
| | Building | Specific Location | | | | |
| A-1 | Washroom #26 | Around Interior Side of Windows | Caulking, White | None Detected | Not Applicable | Not Applicable |
| A-2 | Washroom #26 | Floor by Partition Wall | Leveling Compound, Grey | None Detected | Not Applicable | Not Applicable |
| A-3 | Washroom #26 | Door Frame | Caulking, White | None Detected | Not Applicable | Not Applicable |
| A-4 | Washroom #26 | Base of Walls (Runner) | Plaster, Grey | None Detected | Not Applicable | Not Applicable |
| A-5 | Washroom #26 | Ceiling Space – on Pipe Joints | Sealant, Tan; with Leveling Compound, Grey | None Detected | Not Applicable | Not Applicable |
| A-6 | Washroom #26 | Exterior – Soffit | Soffit Panel, Grey (Green Surfaced) | None Detected | Not Applicable | Not Applicable |
| A-7 | Electrical Building #22 | Exterior – Soffit | Soffit Panel, Grey | None Detected | Not Applicable | Not Applicable |
| A-8 | Electrical Building #22 | Exterior – Soffit | Caulking, White (Green Surfaced) | None Detected | Not Applicable | Not Applicable |
| **A-9** | **Electrical Building #22** | **Roof** | **Felt and Tar, Black** | **Chrysotile** | **04** | **02** |

Note:

- **Bolded text indicates that asbestos is present in the sample.**

### 5.2.1 Lead-Based Paint Screening Using X-Ray Fluorescence (XRF)

ASE Services took spot measurements from 11 surface types with the DELTA Handheld XRF Analyzer at the time of assessment. **Results indicate that nine (9) painted surfaces were above 0.01 mg/cm², and therefore are considered to be lead-containing. The sleeve present in the toilet drain also tested positive for lead.** Table 2 summarizes the locations and descriptions for **each positive sample**. Please refer to ***Appendix II*** for photographs, ***Appendix III*** for sample locations floor plans, and ***Appendix IV*** for the analysis report.

**Table 2: Summary of XRF Point Sample Analysis dated June 15, 2017**

| XRF Sample # | Sample Location | | Sample Description | Lead Content (mg/cm²) | Condition | Photograph # |
|---|---|---|---|---|---|---|
| | Building | Surface/Substrate | | | | |
| **X-1, X-2** | **Washroom #26** | **Wall and Ceiling Panels / Wood** | **Cream Paint** | **0.11 – 5.00** | **Fair to Poor** | **03, 04** |
| **X-3, X-4** | **Washroom #26** | **Doors and Door Frames / Wood** | **Cream Paint** | **0.01 – 5.00** | **Good to Fair** | **05, 06** |
| **X-5** | **Washroom #26** | **Toilet Drain Sleeve** | **Lead Metal, Dark Grey** | **5.00** | **Good** | **07** |
| **X-8** | **Electrical Building #22** | **Exterior Side of Door / Wood** | **Yellow Paint** | **0.70 - 0.75** | **Good** | **08** |
| **X-9** | **Electrical Building #22** | **Exterior, Door Sign / Wood** | **Yellow Paint** | **4.75 - 5.00** | **Fair to Poor** | **08** |
| **X-10** | **Electrical Building #22** | **Door Frame / Metal** | **Brown Paint** | **0.02** | **Good** | **09** |
| **X-11** | **Storage Shed** | **Double Doors / Wood (present beneath green paint on exterior side)** | **Brown Paint** | **0.57 - 0.85** | **Good** | **10** |

Note:

- **Bolded text indicates that the sample is considered to be lead-containing.**

### 5.2.2 Paint Samples Collected to Determine Lead Content

Table 3 summarizes the laboratory sample results and provides an indication of the lead-containing paints present in the building(s). **Results indicate that three (3) samples exceeded the criterion limit of 90 parts per million (ppm), or 0.009 percent by weight[2], and are considered to be lead-containing.** Please refer to ***Appendix II*** for photographs, ***Appendix III*** for sample locations floor plans, and ***Appendix IV*** for the laboratory report.

**Table 3: Summary of Lead Paint Sample Analysis dated June 13, 2017**

| Sample # | Sample Location | | Sample Description | Lead Content (ppm) | Condition | Photograph # |
|---|---|---|---|---|---|---|
| | Building | Surface | | | | |
| **L-1** | **Washroom #26** | **Walls** | **Cream Paint** | **1,100** | **Fair to Poor** | **11** |
| L-2 | Washroom #26 | Exterior Siding | Green Paint | <76 | Good | Not Applicable |
| **L-3** | **Washroom #26** | **Exterior Trim** | **Yellow Paint** | **<95** | **Good** | **12** |
| L-4 | Electrical Building #22 | Soffit | Green Paint | <56 | Fair to Poor | Not Applicable |
| **L-5** | **Electrical Building #22** | **Roof Flashing** | **Cream Paint** | **16,000** | **Fair to Poor** | **13** |
| **L-6** | **Electrical Building #22** | **Door Sign** | **Dark Green Paint** | **23,000** | **Poor** | **14** |

Note:
- **Bolded text indicates that the sample is considered to be lead-containing.**

## 5.3 Mould Growth and Water Damage – Observations and Sample Results

Water damage/staining, as well as potential mould growth was observed in the following areas:

**Washroom #26**
- On the exposed wooden structures in the north section of the building, by the partition wall where the ceiling and wall panels had been removed (see Photograph 15); and
- On the lower section of the wall panel in the south section of the building, along the east wall by the entry doorway into the north section (see Photograph 16).

**Electrical Building #22**
- On the soffit in various areas exhibited by peeling paint, water staining and swelling of the panels (see Photograph 24).

[2] Government of Alberta. Occupational Health and Safety. Lead at The Work Site. (November 2013).

Two (2) mould bulk/tape lift samples were collected from surfaces that were discoloured, and suspected to have mould growth. Results of mould bulk/tape lift sampling indicate that **high levels of *Alternaria* type mould spores were present** on the surface of exposed, wooden framing members by the partition wall. Please refer to Photograph 17 in ***Appendix II***, ***Appendix III*** for sample locations, and ***Appendix IV*** for the laboratory report.

### 5.4 Polychlorinated Biphenyls (PCB's) in Fluorescent Light Ballasts

Fluorescent light fixtures are identified by opening the casing of the light fixtures to visually identify a code stamp on the ballast. In order to safely open the light casing the lighting fixture must be fully de-energized and the power locked out in accordance with the Alberta Occupational Health and Safety Code requirements. At the time of assessment, ASE Services did not identify any light fixtures suspected to contain PCB's.

### 5.5 Mercury in Thermostats and Pressure-Sensing Devices

Mercury and other heavy metals pose a danger to human and environmental health when improperly managed. Common sources of mercury include thermometers, light bulbs and tubes, and thermostats. Mercury thermostats are commonly used in residential and commercial office spaces.

At the time of the assessment, ASE Services observed two (2) boxes of fluorescent light tubes containing mercury dust in the south section of **Washroom #26** (see Photograph 18).

### 5.6 Miscellaneous Chemicals

At the time of the assessment, ASE Services observed miscellaneous chemicals in the following areas:

**Washroom #26**

- Cleaning supplies were observed throughout the north and south sections of the building (see Photograph 19); and
- One (1) fire extinguisher was observed in the north section of the building (see Photograph 20).

**Storage Shed**

- Flammable chemicals stored in a properly labeled unit along the west wall (see Photograph 21);
- Other miscellaneous chemicals on the shelves along the east wall (see Photograph 22); and
- One (1) fire extinguisher was observed by the side entrance door (see Photograph 23).

### 5.7 Radioactive Materials

At the time of the assessment, ASE Services did not observe any potential sources of radioactive materials.

### 5.8 Ozone-Depleting Substances

Ozone-depleting substances (ODS) are human-made chemicals that contain chlorine, fluorine, bromine, carbon and hydrogen that do not readily degrade after being released into the atmosphere. At the time of assessment, ASE Services did not observe any potential ODS-containing equipment.

## 6.0 CONCLUSIONS

Based on the observations and the sampling results, ASE Services makes the following conclusions:

1. Asbestos was determined to be present in the black felt and tar roofing materials of **Electrical Building #22** (see ***Appendix III*** for locations).
2. Lead was determined to be present within the following materials (see ***Appendix III*** for locations):

   **Washroom #26**
   - The cream paint on the wall and ceiling panels throughout the interior of the building;
   - The cream paint on the exterior and interior sides of the entry doors, and all door frames throughout;
   - The yellow paint on the fascia and trim on the exterior of the building; and
   - The sleeves within the toilet drains in both sections of the building. **Please Note:** Three (3) lead sleeves were identified in the north section at the time of the assessment, and three (3) toilet drains with lead sleeves are assumed to be present in the south section of the building as well.

   **Electrical Room #22**
   - The yellow paint on the fascia and trim on the exterior of the building;
   - The cream paint on the roof flashing;
   - The yellow paint on the exterior side of the door;
   - The brown paint on the metal door frame; and
   - The dark green and yellow paints on the door sign.

   **Storage Shed**
   - The yellow paint on the fascia and trim on the exterior of the building; and
   - The brown paint on the double doors.
     **Please Note:** Brown lead-containing paint is assumed to be underneath the green layer of paint on the exterior side of the doors.
3. Water damage was observed at the following locations:

   **Washroom #26**
   - On the lower section of the panel along the east wall in the south section by the partition wall; and
   - On the exposed wooden, framing structures in the north section by the partition wall.

   **Electrical Building #22**
   - In various areas along the soffit.
4. Mould growth was confirmed to be present on the exposed wooden, framing structures by the partition wall in the north section of **Washroom #26.**

5. Two (2) boxes of fluorescent light tubes containing mercury dust were present in the south section of **Washroom #26.**
6. Miscellaneous chemicals of varying types were observed throughout **Washroom #26** and in various areas in the **Storage Shed**.

## 7.0 RECOMMENDATIONS

Based on the above conclusions ASE Services makes the following recommendations:

1. Prior to demolition activities, all asbestos-containing materials that will be impacted must be properly removed and disposed of by a contractor competent in asbestos abatement. All asbestos-containing materials must be removed in accordance with the requirements outlined in the *Alberta Asbestos Abatement Manual* (2012). Please refer to the identified asbestos-containing materials listed in section 6.0.
2. If the identified lead-containing paint is to be impacted during the course of hand demolition activities, it should be removed and disposed of properly by a contractor competent in lead abatement, prior to any such hand demolition. **Please note**: If these buildings, or portions of them are scheduled for demolition by mechanical means, lead paint in good condition (adhering to surface), does not need to be removed prior to demolition; however, lead paint not in good condition (flaking) should be removed by a contractor competent in lead paint abatement.
3. As the buildings assessed are slated for demolition, mould and water damaged materials can be disposed of as regular waste. If the affected building materials are to be removed by hand demolition, they should be remediated following the appropriate high, moderate or low risk procedures as outlined in the Government of Alberta Employment and Immigration – *Best Practices Mould at the Work Site*.
4. Fluorescent light tubes containing mercury dust should be manifested and disposed of properly according to the Waste Control Regulation under the Environmental Protection and Enhancement Act of the province of Alberta.
5. All miscellaneous chemicals must be properly packaged and labelled according to WHMIS regulations. Miscellaneous chemicals must be removed and properly disposed of prior to any demolition activities where these items will be impacted.

**Please note:** Materials that are visually similar to those identified as asbestos- or lead-containing which are observed in locations other than those outlined in this report should be considered to contain asbestos or lead until proven otherwise.

## 8.0 WARRANTY

This report is intended for the exclusive use of the company, organization, or individual to whom it is addressed. It may not be used or relied upon in any manner whatsoever, or for any purpose whatsoever, by any other person. ASE Services makes no representation of fact or opinion of any nature whatsoever to any person other than the company, organization, or individual to whom this report is addressed. The warranty stated above may not be assigned.

If you have any questions or require any additional information, please feel free to contact our project management team at (403) 475-0963.

Sincerely,

Alberta Safety & Environmental Services Ltd.

Reviewed by:

Andrea Irons, B.Sc.
Safety Coordinator

Drafted by: Grace-Ann Palmer, B.Sc., Project Manager

**Attachments:**

- Appendix I: Regulations and Guidelines
- Appendix II: Photographs
- Appendix III: Floor Plans
- Appendix IV: Laboratory Reports and XRF Data
    - Crisp Analytical, L.L.C. Bulk Asbestos Analysis Report dated June 19, 2017
    - ASE Services X-Ray Fluorescence (XRF) Point Sample Analysis Report dated June 15, 2017
    - IATL Lead Paint Sample Analysis Summary Report dated June 13, 2017
    - ASE Services Bulk Mould Analysis Report dated June 06, 2017

# APPENDIX I

# REGULATIONS AND GUIDELINES

The Occupational Health and Safety Act applies to provincially-regulated worksites in the province of Alberta. Under the Occupational Health and Safety Act are the Occupational Health and Safety Regulation, and the Occupational Health and Safety Code. The purpose of the Act, Regulation and Code is to ensure that employers do everything reasonable and practicable to ensure the health and safety of the worker. The Act, Regulation and Code are administered through Alberta Human Resources and Employment – Workplace Health and Safety. The Regulations and Code provide a minimum standard that is enforceable by law for employers and workers to meet their regulatory obligations. Outlined below are portions of the Regulation, Code and CSA Standards. A complete listing of the applicable portions of the Act, Regulation, Code and Alberta Asbestos Abatement Manual are not provided.

Section 15(3) of the Occupational Health and Safety Regulation outlines the requirements for employers with respect to safety training regarding worker exposure to harmful substances. Where workers are exposed to a harmful substance including, but not limited to, asbestos and lead-containing materials, the employer shall:

(a) establish procedures that minimize the worker's exposure to the harmful substance, and
(b) ensure that a worker who may be exposed to the harmful substance
  (i) is trained in the procedures,
  (ii) applies the training, and
  (iii) is informed of the health hazards associated with exposure to the harmful substance.

Part 4 Chemical Hazards, Biological Hazards and Harmful Substances, and Schedule 1 Chemical Substances, of the Alberta Occupational Health and Safety Code establishes the legislative requirements for asbestos and lead.

To assist employers with meeting their statutory requirements, Alberta Workplace Health and Safety has prepared the following documents:

- Alberta Asbestos Abatement Manual, 2012, and
- Safety Bulletin CH061 – Lead in the Workplace, 2013.

**Asbestos**

Asbestos is the common name given to a group of naturally occurring mineral silicates that can be separated into flexible fibres. The name asbestos comes from the Greek word meaning "unquenchable or indestructible." The main properties that make asbestos useful are its incombustibility, strength and flexibility when separated into fibres. It is also effective as a reinforcing or binding agent when combined with cement or plastic.

Many products that at one time contained asbestos are either no longer in use or have been replaced. The uses for asbestos ranged from products in which the fibres were well bound to friable products in which the fibres could easily become airborne. The construction industry was the main user of asbestos products. Sprayed insulation, stucco and joint cements manufactured in Canada and the United States no longer contain asbestos in an unbound form.[3]

The definitions for asbestos can be found in Part 4 of the Occupational Health and Safety Code. Part 4 sets limits for exposure to Chemical Hazards, Biological Hazards and Harmful Substances. Part 4 of the Code (Sections 16 through 27) outlines the General Requirements for employers to ensure worker exposure to a harmful substance is kept as low as reasonably practicable. In summary, the general requirements portion addresses the following:

1. Worker exposure to harmful substances;
2. Worker exposure during shifts greater than 8-hours;
3. Airborne concentration measurements;
4. Potential worker exposure;

[3] Alberta Queen's Printer. Alberta Asbestos Abatement Manual. August 2012.

5. Worker overexposure;
6. Worker decontamination;
7. Emergency bath, showers, eye wash equipment;
8. Prohibited activities;
9. Codes of practice; and
10. Storage of harmful substances.

**Code of Practice:** Section 26 of the Code states that an employer must have a Code of Practice (Management Plan) governing the storage, handling, use and disposal of a substance listed in Schedule 1, Table 1 that is present at a worksite. Asbestos is a substance listed in schedule 1. The Code of Practice must include measures to be used to prevent the uncontrolled release of the substance and the procedures to be followed if there is an uncontrolled release.

Sections 28 through 40 (excluding Section 39) outline the employer's requirements for asbestos at the work site. With respect to managing asbestos-containing materials at a worksite the following sections apply:

**Section 31:** This section states that if it is determined that asbestos fibres may be released into the building then the building is in an unsafe condition and the employer must take all necessary steps to correct the unsafe condition.

**Section 32:** Prohibitions related to the use of asbestos: This section states that a person must not use materials containing crocidolite asbestos in an existing or new building and that a person must not apply asbestos by spraying.

**Section 33:** This section states that a person must not use asbestos in an air distribution system in a form in which asbestos fibres could enter the air supply or return air systems.

**Section 34:** If a building is to be demolished, the employer must ensure that the materials with the potential of releasing fibres are removed prior to demolition.

**Section 35:** If a building is being altered or renovated, the employer must ensure that materials that may be impacted are encapsulated, enclosed or removed.

With respect to the abatement or handling of asbestos-containing materials employers are required to ensure worker exposure is kept to a minimum. In addition to the requirements under the General Provisions portion of the Code, sections 28 through 30, sections 36 through 38 and sections 40 are applicable. Please refer to the Occupational Health and Safety Code for further details or the Alberta Asbestos Abatement Manual.

**Alberta Asbestos Abatement Manual**

To assist employers with meeting their legislative requirements outlined under the Occupational Health and Safety Act, Regulation and Code, Alberta Workplace Health and Safety have published the Alberta Asbestos Abatement Manual. This manual describes the principles to be followed when selecting the most appropriate techniques for the safe abatement of asbestos-containing materials. The manual also presents basic information on asbestos and asbestos products, health hazards, and requirements for worker protection, safe work procedures, inspection criteria, applicable legislation and competency profiles for those persons involved in abatement activities. Work practices and precautions vary considerably with the type of material being removed, the amount of asbestos it contains, its condition and location. The objective of this manual is to present best practices in asbestos abatement that are to be followed in Alberta.

Occupational Health and Safety officers from Alberta Human Resources and Employment use this manual as a guide when reviewing abatement work practices and employer codes of practice. Practices are assessed against those presented in the manual to determine if they meet the intent of the province's occupational health and safety legislation. Alternate practices are acceptable if they provide workers with a level of safety equal to or greater than those

practices presented in this manual.[4] By meeting the requirements of the Alberta Asbestos Abatement Manual the employer will ensure that worker and non-worker (general public) health is protected.

If asbestos is present in the building the Alberta Asbestos Abatement Manual states the following:

> Asbestos must be inhaled to cause disease. Intact and undisturbed asbestos presents no direct health hazard but does present a potential exposure hazard should fibres be released and inhaled. As a result, there is some risk associated with all asbestos installations.

The health risk is considered minimal for asbestos materials in good condition in an inaccessible location and protected from damage. Where damage can be controlled or prevented, managing the exposure risk is often the most cost-effective control measure. Where damage or disturbance cannot be controlled or where deterioration is due to uncontrolled natural causes, management of the exposure risk is very difficult. The use of air monitoring of occupied areas is not considered an acceptable method to determine whether or not asbestos-containing materials must be removed, enclosed, encapsulated or may be left as is (with a management system). Air monitoring alone is insufficient to determine the potential health and exposure risk since asbestos fibres cannot usually be detected above background levels unless the material is disturbed in some way.

Additional criteria are needed to determine the risk of exposure or the need for removal. The Alberta Asbestos Abatement Manual has outlined an assessment exposure algorithm to assist in evaluating the condition of a particular asbestos installation. The following factors should be considered when evaluating the risk of exposure to asbestos:

1. Condition of Material – is the material in a condition to release fibres;
2. Water Damage – has the material been damaged due to water;
3. Exposed Surface Area – how much of the material is exposed;
4. Accessibility – can building occupants access the exposed material;
5. Activity and Movement – amount of activity and air movement in the area;
6. Air Plenum or Direct Air Stream – is the material in a air stream;
7. Friability – can the material be easily crumbled due to hand pressure; and
8. Asbestos Content – type of asbestos and percentage.

**Lead-Based Paint**

Some paints used before 1950 contained as much as fifty percent lead by weight. Lead was often used as a pigment in white and pastel shades. Lead made paint dry faster, last longer and gave the colours a more vibrant look. In the 1950s the amount of lead used in paint decreased as other pigments were substituted. In 1976, federal regulations limited the level of lead in paint to 0.5 percent by weight. In 2009 they were limited the level of lead in paint again to 0.009 percent by weight. Exterior paints could still contain more lead. The yellow markings found on highways still use lead-based paint.[5] By 1991, Canadian paint manufacturers had voluntarily stopped using lead altogether.[6] Currently, paint considered to be lead-containing are those with a content of 90 ppm (0.009%) or greater.

Lead-based paint does not pose a danger if it is in good condition, and is not disturbed. However, if the paint is peeling or flaking, a potentially harmful situation exists. Even friction from opening and closing doors or windows with painted frames can produce paint dust. This dust can get onto children's hands and toys, and from there, into their mouths. Paint chips can

[4] Alberta Queen's Printer. Alberta Asbestos Abatement Manual. August 2012.

[5] Alberta Workplace Health and Safety. Lead in the Workplace (Publication CH061). 2013.

[6] Canada Mortgage and Housing Corporation. Lead in Your Home 1984 Revised and reprinted: 1997, 2003, and 2004.

easily be swallowed by young children. Ledges and trim that are accessible to teething toddlers should also be cause for concern.[7]

The requirements for lead can be found within the Occupational Health and Safety Regulation. Part 4 of the Occupational Health and Safety Code sets limits for exposure to Chemical Hazards, Biological Hazards and Harmful Substances. Part 4 of the Code (Sections 16 through 27) outlines the General Requirements for employers to ensure worker exposure to a harmful substance is kept as low as reasonably practicable. In summary, the general requirements portion addresses the following:

1. worker exposure to harmful substances;
2. worker exposure during shifts greater than 8-hours;
3. airborne concentration measurements;
4. potential worker exposure;
5. worker overexposure;
6. worker decontamination;
7. emergency bath, showers, eye wash equipment;
8. prohibited activities;
9. codes of practice; and
10. storage of harmful substances.

Sections 41 through 43 outline the employer's requirements for lead at the work site. With respect to the Code it primarily applies to managing worker exposure to lead. Lead-based paint should be removed following very specific guidelines according to industry-accepted practices, as well as the Alberta Occupational Health and Safety Act, Regulations and adopted Code.

**Polychlorinated Biphenyls**

PCBs are human-produced chemicals. They do not occur naturally. They are made by attaching chlorine molecules to a biphenyl molecule. There are 209 possible PCB compounds. All PCBs are heavy, colourless oils or resinous solids. They are very stable since they do not react with other chemicals. They have a high boiling point and do not conduct electricity. They are not soluble in water.

Polychlorinated biphenyls are no longer manufactured in North America. They are still found in older electrical transformers and capacitors, heat transfer equipment, and electro-magnets. However, when this equipment is serviced, other fluids replace the PCBs. PCBs or PCB-contaminated materials must be disposed of appropriately.

Storage sites are licensed and inspected regularly by provincial government inspectors. The owner or producer of the PCBs, or PCB-contaminated material, is responsible for their proper disposal or storage. The Waste Control Regulation (ALBERTA REGULATION 192/96) under the Environmental Protection and Enhancement Act outlines the requirements for storage of PCB-containing materials not in use and their disposal. Once fluorescent light ballasts are not in service then they must be stored or disposed of in accordance with the Waste Control Regulation.

**Mercury**

Mercury (Hg) is a very dense metal that expands and retracts evenly with changes in the temperature. Mercury exhibits super conductivity, which is the ability to conduct electrical currents with no resistance, and is the only metal that exists as a liquid at room temperature.

Mercury is released into the air, water and land, and it cycles between them due to its ability to change form with temperature. Mercury gets into the soil through natural breakdown of rocks, the disposal of mercury in landfills, and atmospheric deposition. It enters the water through

[7] Ibid.

runoff, atmospheric deposition, and when products containing mercury are poured down the drain. Mercury is released to the atmosphere through coal-fired utility, chlor-alkali plants, and incinerator emissions, as well as evaporation from water and land. Once mercury enters this cycle, it can remain in the environment for years as it accumulates. Mercury cannot be removed, but it can be prevented from ever entering the environment.

**Miscellaneous Chemicals**

Miscellaneous chemicals may require special handling procedures as outlined under the Occupational Health and Safety Act and Environmental Protection and Enhancement Act. For the purpose of this survey miscellaneous chemicals included materials that had labeling or packaging that falls under the Hazardous Product Act (Workplace Hazardous Materials Information System (WHMIS)) or Transportation of Dangerous Goods Act.

**Radioactive Materials**

Two distinct categories of radiation exist, ionizing and non-ionizing. Within both of these there are a variety of subclasses that exist, such as high frequency with short wavelengths, or low frequency with long wavelengths. Ionizing radiation is provincially and federally regulated in Canada. Provincially the Radiation Protection Act (2010) and Radiation Protection Regulation pertain to the handling and disposal of radiation equipment, such as x-ray equipment, and radiation from non-manmade sources. Federally The Nuclear Safety and Control Act (2015) determines the limits to health and safety to the environment and persons during the development, use, packaging and transport of radioactive materials, particularly in the context of nuclear energy and over the course of the nuclear fuel cycle.

On a smaller scale the Environmental Protection and Enhancement Act (2014) pertains to the handling, transport and disposal of hazardous waste, such as radioactive materials. Disposal of radioactive materials should not occur in municipal landfills unless prior approval has been obtained. Items with radioactive substances should be disassembled according to manufacturer instruction with radioactive segments manifested, packaged and labeled prior to disposal with an appropriate facility. Parts that are non-radioactive, such as the product casings or shells, may be disposed of in municipal landfills.

**Ozone-depleting Substances**

In September of 1993, Alberta enacted the *Ozone-Depleting Substances and Halocarbons Regulation* (AR 181/2000), which governs the use, handling and release of CFCs, HCFCs and halons and other ozone-depleting substances. Provincial regulations require all persons servicing air conditioning or refrigeration equipment to be certified in accordance with the Apprenticeship and Industries Training Act and the associated regulations.

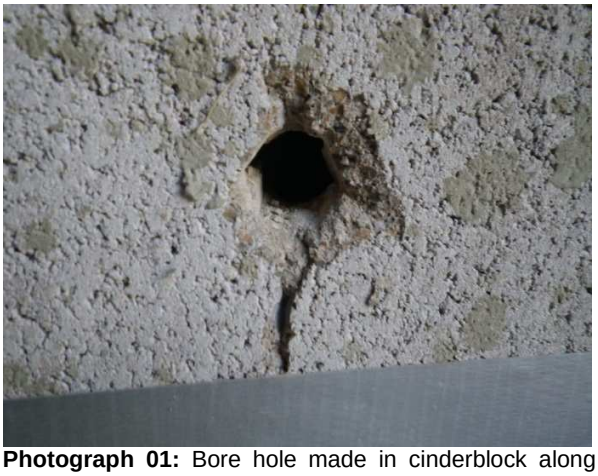
Canada banned chlorinated fluorocarbons as a propellant in aerosol cans in the 1980s, reducing their direct release into the atmosphere. As of January 1, 1996, no CFCs may be produced or imported into Canada.

Hydrochlorofluorocarbons (HCFCs) are chemical compounds related to CFCs and about 95 percent less damaging to the ozone layer. They are mainly used as a refrigerant in domestic air conditioning systems and in manufacturing plastic, insulation and packaging. Because HCFCs do contribute to ozone depletion, Canada is phasing out the production and use of HCFCs between the years 2010-2020. Therefore, HCFCs should only be used as a short-term alternative for replacing CFCs.

Most household refrigerators contain a chlorofluorocarbon refrigerant, sometimes called CFC-12 or R-12. While units manufactured prior to 1993 can contain CFCs or HCFCs, new refrigerators manufactured after 1993 can contain an alternate refrigerant with lower or nonexistent ozone-depleting potential. Alternate refrigerants are continuously being developed. Labels attached to all household units should list the refrigerant being used.

# APPENDIX II

# PHOTOGRAPHS



**Photograph 01:** Bore hole made in cinderblock along the west wall of Electrical Building #22. No vermiculite insulation was observed.

**Photograph 02:** Sample A-9, asbestos-containing black tar and felt on the roof of Electrical Building #22.

**Photograph 03:** Cream, lead-containing paint on the panels along the east wall in Washroom #26. Paint was in poor condition exibited by flaking and peeling.

**Photograph 04:** Cream, lead-containing paint on the ceiling panels in Washroom #26. Paint was in fair to poor condition exibited by flaking and peeling in various areas.

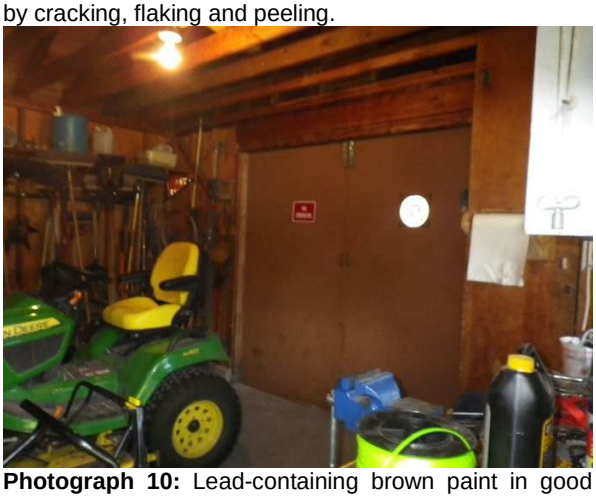
**Photograph 05:** Cream, lead-containing paint on the door and door frames in the south section of Washroom #26. Paint was in fair condition exibited by chips in various areas.

**Photograph 06:** Cream, lead-containing paint on the door and door frames in the north section of Washroom #26. Paint was in fair condition exibited by chips in various areas.

**Photograph 07:** Confirmed lead toilet drain sleeve observed in the north section of Washroom #26.

**Photograph 08:** Yellow, lead-containing paint in good condition on the exterior side of the door of Electrical Building #22. Lead-containing dark green and yellow paints on the sign was in fair to poor condition exibited by cracking, flaking and peeling.

**Photograph 09:** Lead-containing brown paint in good condition on the door frame of Electrical Building #22.



**Photograph 10:** Lead-containing brown paint in good condition on the interior side of the double doors of the Storage Shed. Based on XRF readings, this paint is assumed to be under the green layer of paint on the exterior side.

**Photograph 11:** Sample L-1, cream lead-containing paint collected from various walls in Washroom #26.

**Photograph 12:** Sample L-3, yellow lead-containing paint in good condition collected from the trim on the exterior of the Washroom #26 building.

**Photograph 13:** Sample L-5, cream lead-containing paint collected from the roof flashing of Electrical Building #22. Paint was in fair to poor condition exibited by peeling and flaking in various areas.

**Photograph 14:** Sample L-6, dark green lead-containing paint collected from the sign on the door of Electrical Building #22. Paint was in poor condition exibited by peeling and flaking in various areas.

**Photograph 15:** Water damage/staining on the exposed wooden structures on the north side of the partition wall in Washroom #26.

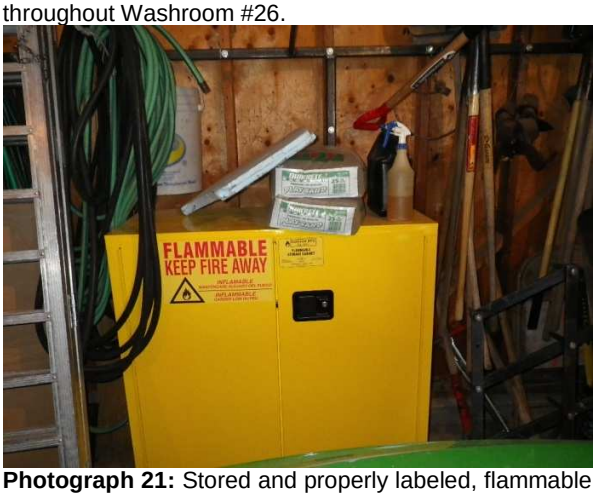
**Photograph 16:** Water damage/staining on the lower section of the panel along the east wall by the entryway in the south section of Washroom #26.

**Photograph 17:** Sample M-1, confirmed mould growth on the exposed wood by the partiiton wall.

**Photograph 18:** Two (2) boxes of fluorescent light tubes with mercury-containing dust. The presence of mercury was confirmed by the “Hg” symbol on the tubes.

**Photograph 19:** Miscellaneous chemicals such as cleaning supplies observed on shelving and other areas throughout Washroom #26.

**Photograph 20:** Fire extinguisher classified as a miscellaneous chemicals item, observed mounted in the north section of Washroom #26.




**Photograph 21:** Stored and properly labeled, flammable chemicals classified as a miscellaneous chemicals item, along the west wall inside the Storage Shed. Other bottled items were observed on top of the storage unit.

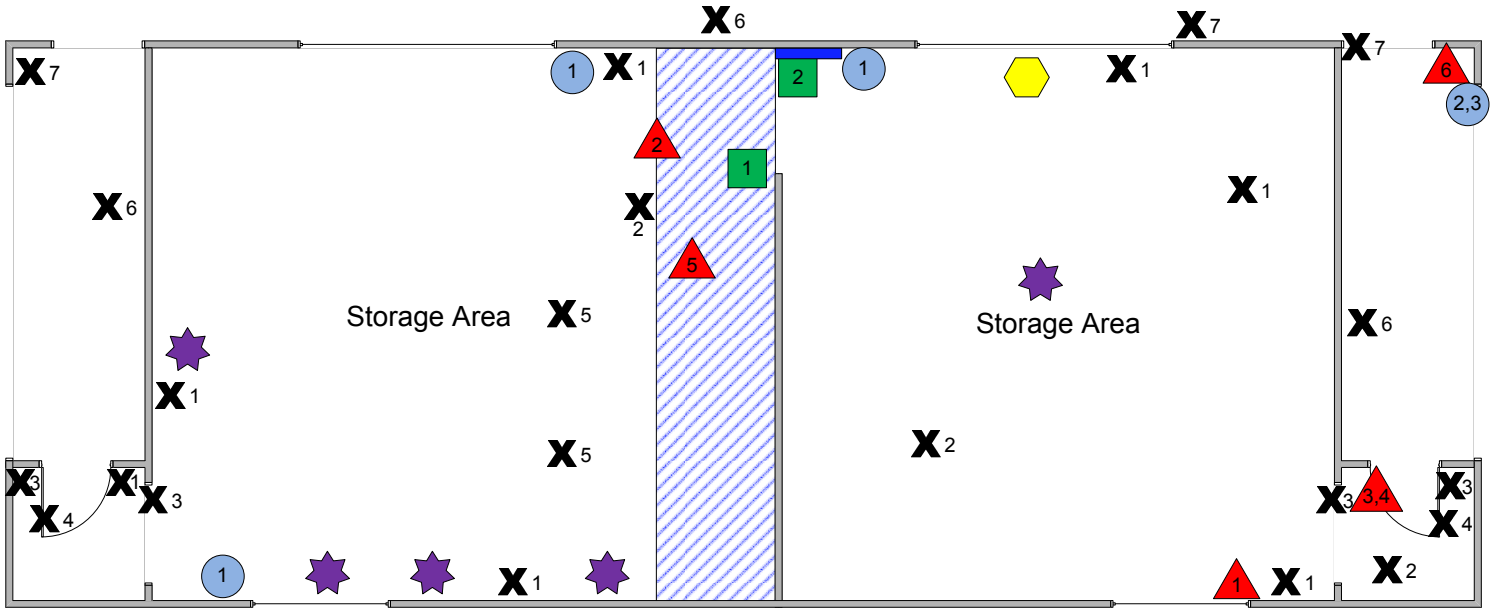
**Photograph 22:** Miscellaneous chemicals on shelving located along the east wall inside the Storage Shed.

**Photograph 23:** Fire extinguisher classified as a miscellaneous chemicals item, observed mounted side, east entry door of the Storage Shed.

**Photograph 24:** Water damage observed on the soffit of Electrical Building #22.

# APPENDIX III

# FLOOR PLANS

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**Hazardous Materials Assessment**
Sample Locations and Observations

***Washroom #26***

**Project #:** AS 8390

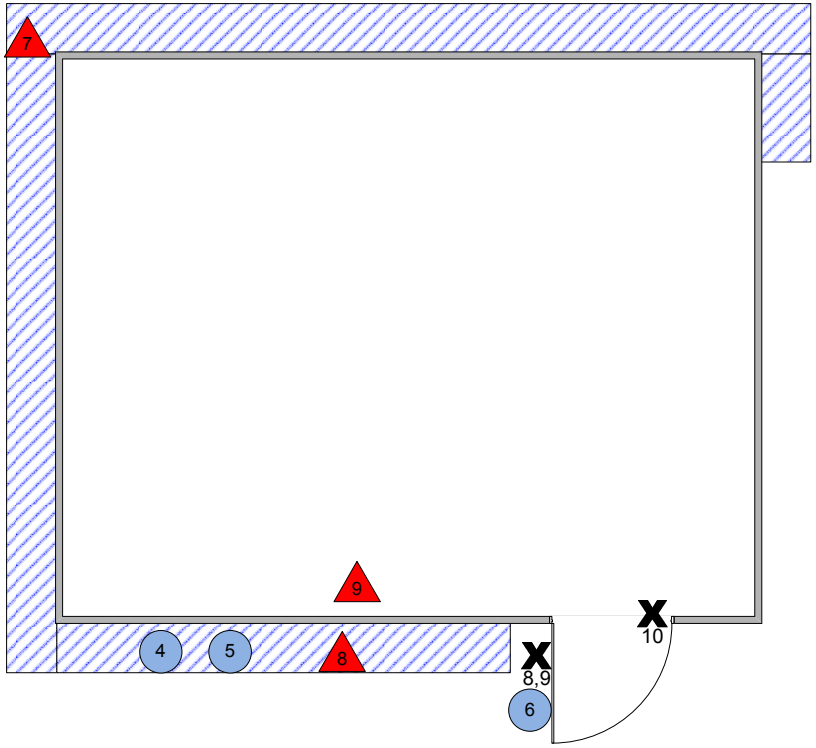
**Client:**
AECOM

**Project Location:**
Waterton Lakes National Park of Canada – Townsite Campground, 200 Vimy Avenue, Waterton, AB

**Legend:**

- Asbestos Sample
- Lead Paint Sample
- Mould Bulk Sample
- XRF Point Sample Location
- Miscellaneous Chemicals
- Mercury
- Water Damage/ Staining - Ceiling
- Water Damage/ Staining - Wall

**Note:**
- Not To Scale

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**Hazardous Materials Assessment**
Sample Locations and Observations

***Electrical Building #22***

**Project #:** AS 8390

**Client:**
AECOM

**Project Location:**

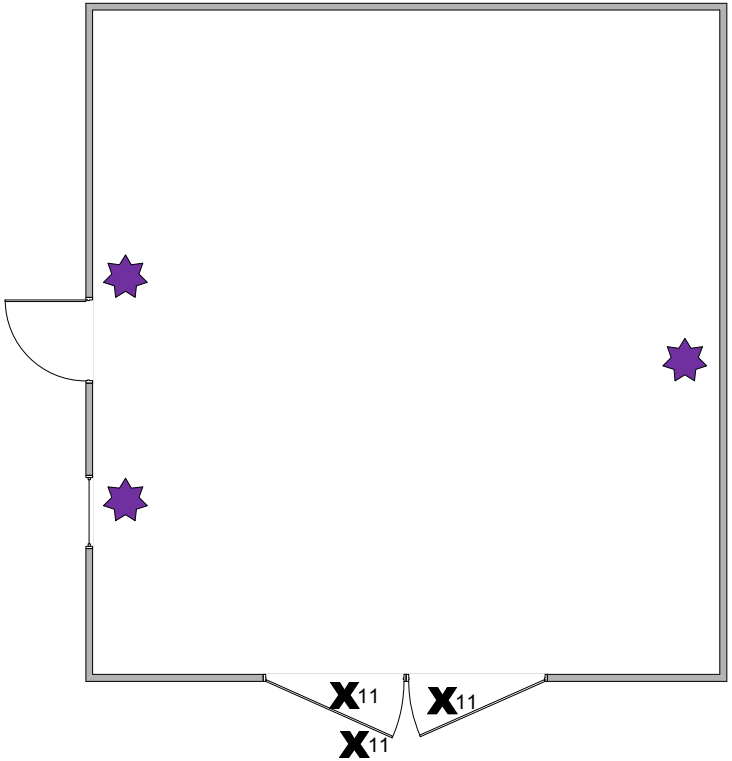
Waterton Lakes National Park of Canada – Townsite Campground, 200 Vimy Avenue, Waterton, AB

**Legend:**

- Asbestos Sample
- Lead Paint Sample
- XRF Point Sample Location
- Water Damage - Soffit

**Notes:**
- Not To Scale

- No vermiculite insulation was observed within the cinderblock wall cavities

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**Hazardous Materials Assessment**
Sample Locations and Observations

***Storage Shed***

**Project #:** AS 8390

**Client:**
AECOM

**Project Location:**

Waterton Lakes National Park of Canada – Townsite Campground, 200 Vimy Avenue, Waterton, AB

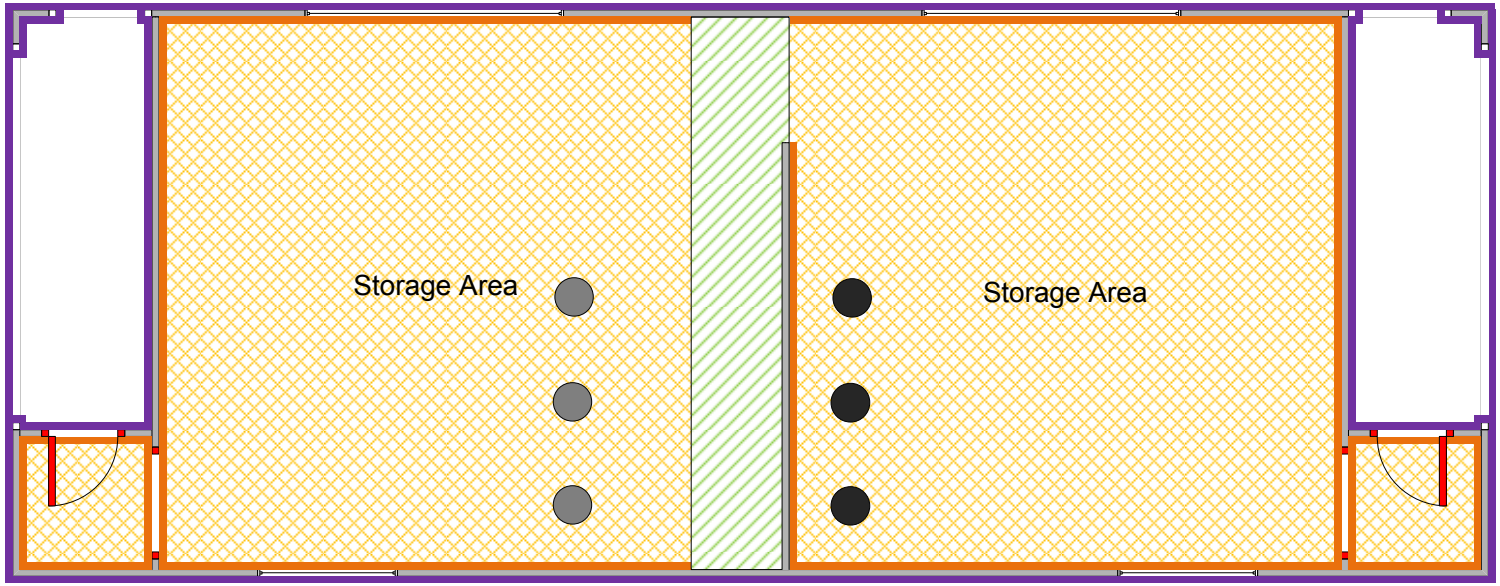
**Legend:**

N

X XRF Point Sample Location

Miscellaneous Chemicals

**Note:**
- Not To Scale




ASE | SERVICES
ALBERTA SAFETY & ENVIRONMENTAL SERVICES

**Hazardous Materials Assessment**
Results
***Washroom #26***

**Project #:** AS 8390

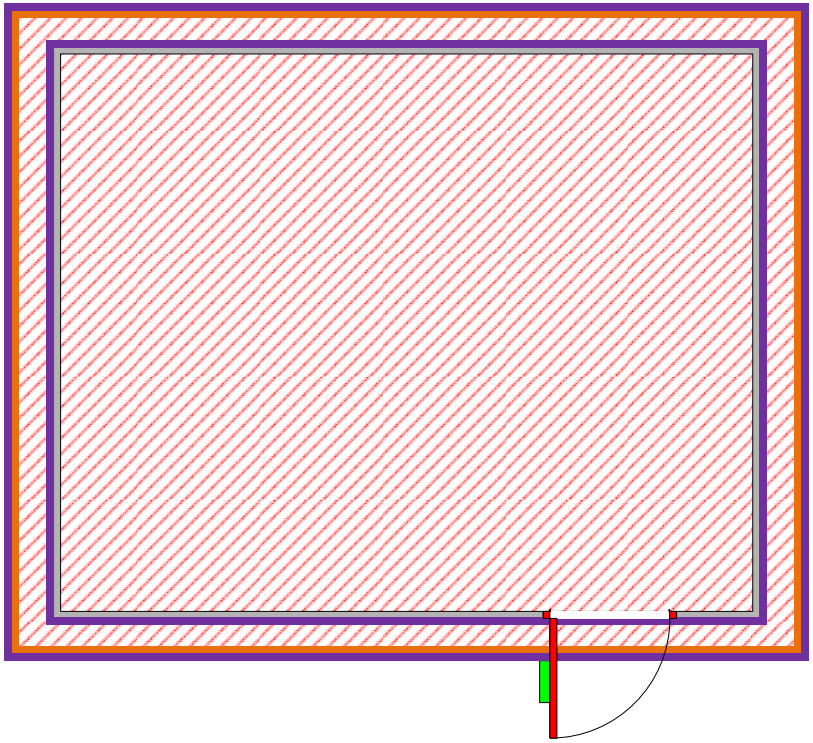
**Client:**
AECOM

**Project Location:**
Waterton Lakes National Park of Canada – Townsite Campground, 200 Vimy Avenue, Waterton, AB

**Legend:**

- Lead-Containing Cream Paint – Ceiling
- Lead-Containing Cream Paint – Walls
- Lead-Containing Yellow Paint – Exterior Trim and Fascia
- Lead-Containing Cream Paint – Door and Frame
- Lead-Containing Cream Paint – Doorframe
- Toilet Drain with Lead Sleeve
- Toilet Drain with Lead Sleeve (Predicted Location*)
- Confirmed Mould Growth on Wooden Members of Exposed Ceiling

**Notes:**
- Not To Scale
* The location of toilet drains could not be confirmed due to the presence of items stored in the south section of the building along the divider wall at the time of the assessment.



ASE | SERVICES
ALBERTA SAFETY & ENVIRONMENTAL SERVICES

**Hazardous Materials Assessment**
Results

***Electrical Building #22***

**Project #:** AS 8390

**Client:**
AECOM

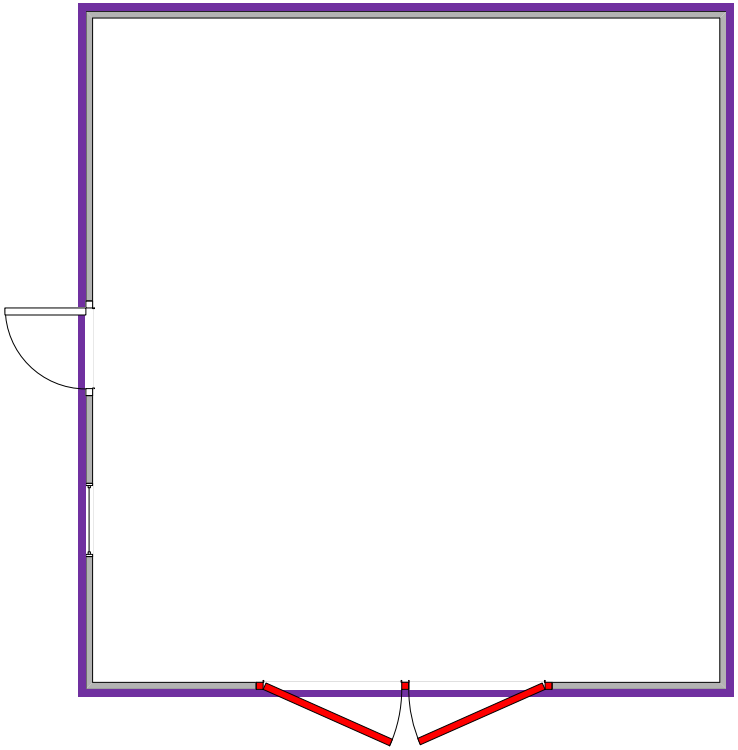
**Project Location:**

Waterton Lakes National Park of Canada – Townsite Campground, 200 Vimy Avenue, Waterton, AB

**Legend:**

- Asbestos-Containing Tar and Felt – Roof
- Lead-Containing Cream Paint – Roof Flashing
- Lead-Containing Yellow Paint – Exterior Trim and Fascia
- Lead-Containing Paints
  - Door Frame (brown)
  - Exterior Side of Door (yellow)
- Lead-Containing Paints on Sign – Dark Green and Yellow

**Note:**
- Not To Scale



ASE | SERVICES
ALBERTA SAFETY & ENVIRONMENTAL SERVICES

**Hazardous Materials Assessment**
Results

***Storage Shed***

**Project #:** AS 8390

**Client:**
AECOM

**Project Location:**
Waterton Lakes National Park of Canada – Townsite Campground, 200 Vimy Avenue, Waterton, AB

**Legend:**

N

Lead-Containing Brown Paint – Doors*

Lead-Containing Yellow Paint – Exterior Trim and Fascia

**Notes:**
- Not to Scale

- Based on XRF point sample results (X-11), brown lead-containing paint is assumed to be beneath the green paint layer of the double doors.

# APPENDIX IV

# LABORATORY REPORTS

**CA Labs**
**Dedicated to Quality**

***Crisp Analytical, L.L.C.***
*1929 Old Denton Road*
*Carrollton, TX 75006*
*Phone 972-242-2754*
*Fax 972-242-2798*

***CA Labs, L.L.C.***
*12232 Industriplex, Suite 32*
*Baton Rouge, LA 70809*
*Phone 225-751-5632*
*Fax 225-751-5634*

# *Materials Characterization - Bulk Asbestos Analysis*

**Laboratory Analysis Report - Polarized Light**

***ASE Services***
2216 27th Ave. NE, Ste. 208
Calgary, AB T2E 7A7

Customer Project: RE:CAL17063402JD, AS 8390 Waterton Townsite Ca
Reference #: CAL17063402Amende Date: 6/19/2017

## Analysis and Method

Summary of polarized light microscopy (PLM / Stereomicroscopy bulk asbestos analysis) using the methods described in 40CFR Part 763 Appendix E to Subpart E (Interim and EPA 600 / R-93 / 116 (Improved). The sample is first viewed with the aid of a stereomicroscope. Numerous liquid slide preparations are created for analysis under the polarized microscope where identifications and quantifications are preformed. Calibrated liquid refractive oils are used as liquid mouting medium. These oils are used for identification (dispersion staining). A calibrated visual estimation is reported, should any asbestiform mineral be present. Other techniques such as acid washing are used in conjugation with refractive oils for detection of smaller quantities of asbestos. All asbestos percentages are based on calibrated visual estimation traceable to NIST standards for regulated asbestos. Traceability to measurement and calibration is achieved by using known amounts and types of asbestos from standards where analyst and laboratory accuracy are measured. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 0.50% (well above the laboratory definition of trace).

## Discussion

Vermiculite containing samples may contain trace amounts of actinolite/tremolite. When not detected by PLM, these samples should be analyzed using TEM methods and / or water separation techniques. Suspected actinolite/vermiculite presence will be indicated through the sample comment section of this report.

Fibrous talc containing samples may contain a regulated asbestos fiber known as anthophyllite. Under certain conditions the same fiber may actually contain both talc and anthophyllite (a phenomenon called intergrowth). Again, TEM detection methods are recommended. CA Labs PLM report comments will denote suspected amounts of asbestiform anthophyllite with talc, where further analysis is recommended.

Some samples (floor tiles, surfacings, etc.) may contain fibers too small to be delectable by PLM analysis and should be analyzed by TEM bulk protocols.

A "trace asbestos" will be reported if the analyst observes far less than 1% asbestos. CA Labs defines "trace asbestos" as a few fibers detected by the analyst in several preparations and will indicate as such under these circumstances.

Since allowable variation in quantification of samples close to 1% is high, <1% may be reported. Such results are ideal for point counting, and the technique is mandatory for friable samples (NESHAP, Nov. 1990 and clarification letter 8 May 1991) under 1% percent asbestos or "trace asbestos". **In order to make all initial PLM reports issued from CA Labs NESHAP compliant, all <1% asbestos results (except floor tiles) will be point counted at no additional charge.**

## Qualifications

CA Labs is accredited by the National Voluntary Accreditation Program (NVLAP) for selected test methods for airborne fiber analysis (TEM), and for bulk asbestos fiber analysis (PLM). CA Labs is also accredited by AIHA LAP, LLC. in the PLM asbestos field of testing for Industrial Hygiene. All analysts have completed college courses or hold a degree in a natural science (geology, biology, or environmental science). Recognition by a state professional board in one these disciplines is preferred, but not required. Extensive in-house training programs are used to augment the educational background of the analyst. The Laboratory Director and Quality Manager have received supplemental McCrone Research training for asbestos identification. Analysis performed at Crisp Analytical Labs, LLC 1929 Old Denton Road Carrollton, TX 75006

*Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235*
***AIHA LAP, LLC Laboratory #102929***

**CA Labs**
**Dedicated to Quality**

***Crisp Analytical, L.L.C.***
*1929 Old Denton Road*
*Carrollton, TX 75006*
*Phone 972-242-2754*
*Fax 972-242-2798*

***CA Labs, L.L.C.***
*12232 Industriplex, Suite 32*
*Baton Rouge, LA 70809*
*Phone 225-751-5632*
*Fax 225-751-5634*

# *Overview of Project Sample Material Containing Asbestos*

**Customer Project:** RE:CAL17063402JD, AS 8390 Waterton Townsite C **CA Labs Project #:** CAL17063402AmendedAF

| Sample # | Layer # | Analysts Physical Description of Subsample | Asbestos type / calibrated visual estimate percent | List of Affected Building Material Types |
|---|---|---|---|---|
| A-9 | *9-1* | ***Electrical Bldg.-Roof Black Felt And Tar**/ black tar and black felt* | ***4% Chrysotile*** | ***black tar and black felt*** |

*Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235*
***AIHA LAP, LLC Laboratory #102929***

***Glossary of abbreviations (non-asbestos fibers and non-fibrous minerals):***

ca - carbonate
gypsum - gypsum
bi - binder
or - organic
ma - matrix
mi - mica
ve - vermiculite
ot - other
pe - perlite
qu - quartz
fg - fiberglass
mw - mineral wool
wo - wollastinite
ta - talc
sy - synthetic
ce - cellulose
br - brucite
ka - kaolin (clay)
pa - palygorskite (clay)

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**CA Labs**
**Dedicated to Quality**

***Crisp Analytical, L.L.C.***
*1929 Old Denton Road*
*Carrollton, TX 75006*
*Phone 972-242-2754*
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*12232 Industriplex, Suite 32*
*Baton Rouge, LA 70809*
*Phone 225-751-5632*
*Fax 225-751-5634*

# *Polarized Light Asbestiform Materials Characterization*

**Customer Info**: **Attn:**
***ASE Services***
2216 27th Ave. NE, Ste. 208
Calgary, AB T2E 7A7

Phone # 403-475-0963
Fax # 403-475-0971

**Customer Project:**
RE:CAL17063402JD, AS 8390
Waterton Townsite
Campground
**Turnaround Time:**
5 Days

**CA Labs Project #:**
CAL17063402AmendedAF

**Date:** 6/19/2017
**Samples Received:** 6/6/17 10:30am
**Date Of Sampling:** 6/2/2017
**Purchase Order #:** AS 8390

| Sample # | Comment | Layer # | Analysts Physical Description of Subsample | Homogeneous (Y/N) | Asbestos type / calibrated visual estimate percent | Non-asbestos fiber type / percent | Non-fibrous type / percent |
|---|---|---|---|---|---|---|---|
| A-1 | | *1-1* | ***Washroom #26-Window Frames (Int) Caulking**/ white surfaced white caulking* | *n* | ***None Detected*** | | 100% qu,gy,bi |
| A-2 | | *2-1* | ***Washroom #26-Floor Leveling Compound**/ gray leveling plaster* | *y* | ***None Detected*** | | 100% qu,ca |
| A-3 | | *3-1* | ***Washroom #26-Door Frame Caulking**/ white surfaced white caulking* | *n* | ***None Detected*** | | 100% qu,gy,bi |
| A-4 | | *4-1* | ***Washroom #26-Base Of Walls Concrete Runner**/ gray surfaced gray plaster* | *n* | ***None Detected*** | | 100% qu,bi,ca |
| A-5 | | *5-1* | ***Washroom #26-Pipe Joint By Partition Wall Abv. Ceiling Sealant**/ tan mastic* | *y* | ***None Detected*** | | 100% gy,bi |
| | | *5-2* | *gray leveling compound* | *y* | ***None Detected*** | | 100% qu,ca |
| A-6 | | *6-1* | ***Washroom #26-Exterior Siding Panel**/ green surfaced gray paneling* | *n* | ***None Detected*** | 36% ce | 64% qu,bi,ca |

*Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235*

***AIHA LAP, LLC Laboratory #102929***

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

| | | | |
|---|---|---|---|
| ca - carbonate | mi - mica | fg - fiberglass | ce - cellulose |
| gy - gypsum | ve - vermiculite | mw - mineral wool | br - brucite |
| bi - binder | ot -other | wo - wollastonite | ka - kaolin (clay) |
| or - organic | pe - perlite | ta - talc | pa - palygorskite (clay) |
| ma - matrix | qu - quartz | sy - synthetic | |

Approved Signatories:

Tanner Rasmussen
Analyst

Analyst/Lab Supervisor
Tanner Rasmussen

Technical Manager
Chad Lytle

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze
6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

**CA Labs**
**Dedicated to Quality**

***Crisp Analytical, L.L.C.***
*1929 Old Denton Road*
*Carrollton, TX 75006*
*Phone 972-242-2754*
*Fax 972-242-2798*

***CA Labs, L.L.C.***
*12232 Industriplex, Suite 32*
*Baton Rouge, LA 70809*
*Phone 225-751-5632*
*Fax 225-751-5634*

# *Polarized Light Asbestiform Materials Characterization*

**Customer Info**: **Attn:**
***ASE Services***
2216 27th Ave. NE, Ste. 208
Calgary, AB T2E 7A7

Phone # 403-475-0963
Fax # 403-475-0971

**Customer Project:**
RE:CAL17063402JD, AS 8390
Waterton Townsite
Campground
**Turnaround Time:**
5 Days

**CA Labs Project #:**
CAL17063402AmendedAF

**Date:** 6/19/2017
**Samples Received:** 6/6/17 10:30am
**Date Of Sampling:** 6/2/2017
**Purchase Order #:** AS 8390

| Sample # | Comment | Layer # | Analysts Physical Description of Subsample | Homogeneous (Y/N) | Asbestos type / calibrated visual estimate percent | Non-asbestos fiber type / percent | Non-fibrous type / percent |
|---|---|---|---|---|---|---|---|
| A-7 | | *7-1* | ***Electrical Bldg.-Exterior Soffit Panel**/ gray paneling* | *y* | ***None Detected*** | 37% ce | 63% qu,ca,ma |
| A-8 | | *8-1* | ***Electrical Bldg.-Exterior Soffit Caulking**/ green surfaced white caulking* | *n* | ***None Detected*** | | 100% qu,gy,bi |
| A-9 | | *9-1* | ***Electrical Bldg.-Roof Black Felt And Tar**/ black tar and black felt* | *n* | ***4% Chrysotile*** | 25% ce | 71% qu,bi |

*Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235*

***AIHA LAP, LLC Laboratory #102929***

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

| | | | |
|---|---|---|---|
| ca - carbonate | mi - mica | fg - fiberglass | ce - cellulose |
| gy - gypsum | ve - vermiculite | mw - mineral wool | br - brucite |
| bi - binder | ot -other | wo - wollastonite | ka - kaolin (clay) |
| or - organic | pe - perlite | ta - talc | pa - palygorskite (clay) |
| ma - matrix | qu - quartz | sy - synthetic | |

Approved Signatories:

Tanner Rasmussen
Analyst

Analyst/Lab Supervisor
Tanner Rasmussen

Technical Manager
Chad Lytle

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze
6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

ASE | SERVICES
ALBERTA SAFETY & ENVIRONMENTAL SERVICES

# X-RAY FLUORESCENCE (XRF) POINT SAMPLE ANALYSIS REPORT

**CLIENT:** AECOM
**PROJECT NAME:** Waterton Lakes National Park, Townsite Campground - 200 Vimy Road, Waterton, Alberta
**PROJECT #:** AS 8390

**Test Date:** June 2, 2017
**Report Date:** June 15, 2017

| Building | Sample Location # | Location | Surface | Substrate | Paint Colour | Lead Concentration (mg/cm²) | LBP Error (mg/cm²) |
|---|---|---|---|---|---|---|---|
| | | | **Cailbration Check - Pass** | | | | |
| | | | **NIST Standard - SRM 2573** | | **Orange** | **0.81** | **0.10** |
| | | | **NIST Standard - SRM 2570** | | **White** | **0.00** | **0.00** |
| Washroom 26 | X-1 | Interior | Walls | Wood Panels | Cream | 5.00 | 0.80 |
| Washroom 26 | X-1 | Interior | Walls | Wood Panels | Cream | 5.00 | 0.78 |
| Washroom 26 | X-1 | Interior | Walls | Wood Panels | Cream | 4.84 | 0.64 |
| Washroom 26 | X-1 | Interior | Walls | Wood Panels | Cream | 5.00 | 0.78 |
| Washroom 26 | X-1 | Interior | Walls | Wood Panels | Cream | 5.00 | 0.62 |
| Washroom 26 | X-1 | Interior | Walls | Wood Panels | Cream | 0.22 | 0.01 |
| Washroom 26 | X-2 | Interior | Ceiling | Wood Panels | Cream | 0.13 | 0.01 |
| Washroom 26 | X-2 | Interior | Ceiling | Wood Panels | Cream | 0.13 | 0.01 |
| Washroom 26 | X-2 | Interior | Ceiling | Wood Panels | Cream | 0.11 | 0.01 |
| Washroom 26 | X-3 | Interior | Door Frames | Wood | Cream | 5.00 | 0.69 |
| Washroom 26 | X-3 | Interior | Door Frames | Wood | Cream | 5.00 | 0.59 |
| Washroom 26 | X-3 | Interior | Door Frames | Wood | Cream | 5.00 | 1.20 |
| Washroom 26 | X-3 | Interior | Door Frames | Wood | Cream | 5.00 | 0.72 |
| Washroom 26 | X-4 | Interior | Doors | Wood | Cream | 0.02 | 0.00 |
| Washroom 26 | X-4 | Interior | Doors | Wood | Cream | 0.01 | 0.00 |
| Washroom 26 | X-4 | Interior | Doors | Wood | Cream | 0.01 | 0.00 |
| Washroom 26 | X-4 | Interior | Doors | Wood | Cream | 0.05 | 0.00 |
| Washroom 26 | X-4 | Interior | Doors | Wood | Cream | 0.21 | 0.02 |
| Washroom 26 | X-5 | Interior | Toilet Drain Sleeve | Unknown | Dark Grey | 5.00 | 0.77 |
| Washroom 26 | X-5 | Interior | Toilet Drain Sleeve | Unknown | Dark Grey | 5.00 | 0.72 |
| Washroom 26 | X-5 | Interior | Toilet Drain Sleeve | Unknown | Dark Grey | 5.00 | 0.91 |
| | | | **Cailbration Check - Pass** | | | | |
| Washroom 26 | X-6 | Exterior | Siding | Wood | Green | 0.00 | 0.00 |
| Washroom 26 | X-6 | Exterior | Siding | Wood | Green | 0.00 | 0.00 |
| Washroom 26 | X-6 | Exterior | Siding | Wood | Green | 0.00 | 0.00 |
| Washroom 26 | X-7 | Exterior | Trim | Wood | Yellow | 0.00 | 0.00 |
| Washroom 26 | X-7 | Exterior | Trim | Wood | Yellow | 0.00 | 0.00 |

| Building | Sample Location # | Location | Surface | Substrate | Paint Colour | Lead Concentration (mg/cm²) | LBP Error (mg/cm²) |
|---|---|---|---|---|---|---|---|
| Washroom 26 | X-7 | Exterior | Trim | Wood | Yellow | 0.00 | 0.00 |
| | | | | | | | |
| Electrical 22 | X-8 | Exterior | Door | Wood | Yellow | 0.75 | 0.07 |
| Electrical 22 | X-8 | Exterior | Door | Wood | Yellow | 0.70 | 0.07 |
| Electrical 22 | X-8 | Exterior | Door | Wood | Yellow | 0.75 | 0.09 |
| Electrical 22 | X-9 | Exterior | Door Sign | Wood | Yellow | 4.82 | 0.43 |
| Electrical 22 | X-9 | Exterior | Door Sign | Wood | Yellow | 5.00 | 0.48 |
| Electrical 22 | X-9 | Exterior | Door Sign | Wood | Yellow | 4.75 | 0.43 |
| Electrical 22 | X-10 | Exterior/Interior | Door Frame | Metal | Brown | 0.02 | 0.00 |
| Electrical 22 | X-10 | Exterior/Interior | Door Frame | Metal | Brown | 0.02 | 0.00 |
| Electrical 22 | X-10 | Exterior/Interior | Door Frame | Metal | Brown | 0.02 | 0.00 |
| | | | | | | | |
| Storage Shed | X-11 | Interior | Double Doors | Wood | Brown | 0.76 | 0.07 |
| Storage Shed | X-11 | Interior | Double Doors | Wood | Brown | 0.85 | 0.12 |
| Storage Shed | X-11 | Exterior | Double Doors | Wood | Green (Brown underneath) | 0.57 | 0.04 |

**Notes:**
"LBP" means Lead-Based Paint
ASTM E211900 Standard Practice for Quality Systems for Conducting in Situ Measurements of Lead Content in Paint or Other Coatings Using Field-Portable X-Ray Fluorescence (XRF) Devices
Limit of Detection 0.1 µg/cm²

Reviewed by: Lisa Hundey, BASc, EPt

Date: 15-Jun-17

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

# CERTIFICATE OF ANALYSIS

**Client:** Alberta Safety & Environmental Services
208, 2216 27th Ave NE
Calgary AB T2E 7A7

**Client:** ALB464

**Report Date:** 6/13/2017
**Report No.:** 538040 - Lead Paint
**Project:** Waretown Townsite Campground
**Project No.:** AS 8390

## LEAD PAINT SAMPLE ANALYSIS SUMMARY

**Lab No.:** 6251917 **Description:** Cream Paint **Result (% by Weight):** 0.11
**Client No.:** L-1 **Location:** Washroom #26-Walls, 5-June-17 **Result (ppm):** 1100
**Comments:**

---

**Lab No.:** 6251918 **Description:** Green Paint **Result (% by Weight):** <0.0076
**Client No.:** L-2 **Location:** Washroom #26-Ext. Siding, 5-June-17 **Result (ppm):** <76
**Comments:**

---

**Lab No.:** 6251919 **Description:** Yellow Paint **Result (% by Weight):** <0.0095
**Client No.:** L-3 **Location:** Washroom #26-Ext. Trim, 5-June-17 **Result (ppm):** <95
**Comments:**

---

**Lab No.:** 6251920 **Description:** Green Paint **Result (% by Weight):** <0.0056
**Client No.:** L-4 **Location:** Electrical Bldg. #22-Soffit, 5-June-17 **Result (ppm):** <56
**Comments:**

---

**Lab No.:** 6251921 **Description:** Cream Paint **Result (% by Weight):** 1.6
**Client No.:** L-5 **Location:** Electrical Bldg. #22-Roof Flashing, 5-June-17 **Result (ppm):** 16000
**Comments:**

---

**Lab No.:** 6251922 **Description:** Dark Green Paint **Result (% by Weight):** 2.3
**Client No.:** L-6 **Location:** Electrical Bldg. #22-Door Sign, 5-June-17 **Result (ppm):** 23000
**Comments:**

Please refer to the Appendix of this report for further information regarding your analysis.

**Date Received:** 6/6/2017
**Date Analyzed:** 06/13/2017
**Signature:**
**Analyst:** Chad Shaffer

**Approved By:**
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

# CERTIFICATE OF ANALYSIS

**Client:** Alberta Safety & Environmental Services
208, 2216 27th Ave NE
Calgary AB T2E 7A7

**Client:** ALB464

**Report Date:** 6/13/2017
**Report No.:** 538040 - Lead Paint
**Project:** Waretown Townsite Campground
**Project No.:** AS 8390

# Appendix to Analytical Report:

**Customer Contact:**
**Analysis:** ASTM D3335-85a

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

**iATL Customer Service:** customerservice@iatl.com
**iATL Office Manager:** cdavis@iatl.com
**iATL Account Representative:** Alyssa Peiffer
**Sample Login Notes:** See Batch Sheet Attached
**Sample Matrix:** Paint
**Exceptions Noted:** See Following Pages

## General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

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This report shall not be reproduced except in full, without written approval of the laboratory.

## Information Pertinent to this Report:

Analysis by ASTM D3335-85a by AAS

Certification:
- National Lead Laboratory Program (NLLAP): AIHA-LAP, LLC No. 100188
- NYSDOH-ELAP No. 11021

Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation.
All results are based on the samples as received at the lab. iATL assumes that appropriate sampling methods have been used and that the data upon which these results are based have been accurately supplied by the client.
Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Apendix B.
Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies.
LSD=0.2 ppm MDL=0.005% by weight. RL= 0.010% by weight (based upon 100 mg sampled).

## Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a complete list with highlighted disclaimers pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com.**

* Insufficient sample provided to perform QC reanalysis (<200 mg)

** Not enough sample provided to analyze (<50 mg)

*** Matrix / substrate interference possible.

ASE | SERVICES

ALBERTA SAFETY & ENVIRONMENTAL SERVICES

# BULK MOULD ANALYSIS REPORT

**Client:** AECOM
**Project #:** AS 8390
**Description:** Waterton Townsite Campground - 200 Vimy Avenue, Waterton, AB

**Sample Date:** 05-Jun-17
**Analysis Date:** 06-Jun-17

| Sample # | Lab # | Sample Description | Background Debris(1) | Mould Spore Identification | Relative Amount(2) |
|---|---|---|---|---|---|
| M-1 | 17-4308 | Washroom #26 - Wood Panels, Ceiling by Partition Wall | Low | Alternaria | High |
| M-2 | 17-4309 | Washroom #26 - East Wall, by Partition Wall | Low | No fungal fragments observed. | |

Notes:
1 Background Debris refers to loading of non-fungal fragments.'Low'=0-10%; 'Moderate'=11-30%; 'High'=>30%
2 Relative amount: 'Low' = <10 per $mm^2$ of tape surface;Moderate' = 10-100 per $mm^2$; 'High' = >100 per $mm^2$

Results Reviewed by: Silvana Wu

Date: 06-Jun-17

# Appendix C

## Geotechnical Reports and Existing Road Core Holes

# GEOTECHNICAL INVESTIGATION

---

## FOR THE PROPOSED
## WATERTON PARK/CAMPGROUND
## WASHROOM FACILITY

## LOCATED
WITHIN NATIONAL WATERTON PARK

## WATERTON, ALBERTA

SUBMITTED TO:
ZEIDLER PARTNERSHIP ARCHITECTS

ATTENTION:
MS. PATRICIA MOHRMANN

PREPARED BY:

GLOBAL ENGINEERING AND TESTING LTD.
15, 3500 - 27 Street NE
Calgary, AB T1Y 5E2
Phone: 291-5091 Fax: 291-9729
Email: global.engineering@shaw.ca

AUGUST 2008

FILE NO.: 082-1589-8

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| 3.0 | Site Description | 2 |
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| **APPENDIX I** | **PLATE NO.** |
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| Site Map | I-1 |
| Site Plan | I-2 |
| Testhole Logs | I-3 to I-5 |

**APPENDIX II**

General Conditions
Footings
Floor Slab-On-Grade
Asphalt Pavements
Recommended Gradation Limits for Crushed Granular Base Course Materials
Recommended Gradation Limits for Bedding and Drainage Materials

## 1.0 INTRODUCTION

This report presents results of a Geotechnical Investigation at the site of the proposed washroom buildings located within the Waterton National Park in Waterton, Alberta (see Plate I-1, Appendix I). The purpose of the investigation was to determine the subsurface soil conditions at the site and to provide geotechnical data for the design/construction of the proposed buildings.

It is understood that the proposed development will consist of two separate washroom buildings (one is to be located in the campground and one in the playground area).

Written authorization to proceed with this investigation was received on August 11, 2008 from Mr. Steven Carruthers of Public Works and Government Services Canada. Fieldwork was carried out in August 12, 2008. A total of 3 testholes were drilled at the site using a truck-mounted solid stem auger. Locations of the testholes are shown on the site plan (see Plate I-2, Appendix I). The testhole elevations are referenced to the existing grade.

## 2.0 FIELD AND LABORATORY INVESTIGATION

Three testholes were drilled at the site to delineate the subsoil stratigraphy and to provide samples for laboratory testing. The depth of borehole penetration ranged from 3.7 to 4.9 metres below the existing grade. Disturbed soil samples from the drill were collected at regular intervals. Standard penetration tests were performed at selected depths in the testholes to determine the in-situ character of the site soils. Open standpipe was installed in one of the testholes to permit groundwater monitoring.

Standard laboratory tests were performed on representative soil samples acquired from the field to determine the soil identification and water-soluble sulphate contents.

Results of these tests are summarized on the testhole logs (see Plates I-3 to I-5, Appendix I).

## 3.0 SITE DESCRIPTION

The proposed development for washroom facilities are located in the Waterton National Park, Alberta. In the playground and campground area, currently occupied by existing washroom facilities. Numerous sport facilities and children playground existed at the park.

In general, the park was located on the south of Harebell Road, west of Wind Flower Avenue. Waterton lakes were located west of the site. The topography of the site was relatively flat with a slightly downward sloping to the southeast of the park. Numerous of gravelly access roads were present within the park.

## 4.0 SUBSURFACE FEATURES

### 4.1 Subsoil Conditions

Based upon the testhole information, the stratigraphy of the site generally consists of topsoil and underlying sandy gravel.

Detailed soil information is summarized on the testhole logs (see Plates I-3 to I-5, Appendix I). General soil information encountered at the site is described as follows:

#### 4.1.1 Topsoil

0.2 to 0.8 metre thick topsoil was logs at the ground surface in the three testholes. The topsoil contains rootlets and tends to be softened upon wetting. This topsoil in the area of the building, road and parking lot should be stripped off during rough grading of the site.

#### 4.1.2 Sandy Gravel

Underlying the topsoil was a sandy to silty gravel stratum. The gravel is generally well-graded and consists of fairly well-rounded pebbles and cobbles. Based on compact penetration tests and the gravel deposit had a compact dense relative density.

### 4.2 Groundwater Conditions

Open standpipe was installed in one of testholes to monitor the groundwater level at the site. The groundwater level readings are recorded as follows:

| DEPTH OF WATER BELOW EXISTING GRADE (metres) | |
|---|---|
| Testhole No. | August 12, 2008 |
| 1 | Dry |
| 2 | Dry |
| 3 | Dry |

Fluctuation of the groundwater table can be expected, especially in response to snowmelt or heavy rainfall. It is recommended that the client should continue to monitor the water table to provide up-to-date information, particularly immediately prior to the start of construction. Alternatively, arrangements can be made for Global Engineering and Testing Ltd. to provide a water monitoring service.

## 5.0 RECOMMENDATIONS

Based on the interpretation of subsurface soil conditions found in the testholes, the following recommendations are believed to be pertinent for the design/construction of the structure:

### 5.1 General

It is our understanding that the proposed development will consist of a one-storey building structure without a basement. The soil conditions encountered at the site are believed to be suitable to the construction of the proposed building.

### 5.2 Foundations

Based on the testhole information, continuous and/or spread footing are considered to be suitable foundation for supporting structural loads of the proposed building.

### 5.2.1 Continuous and/or Spread Footings

Continuous and/or spread footings may be proportioned, based on a maximum net allowable bearing pressure of 200 kPa (4180 psf). Footings must be founded at a minimum depth of 1.4 metres below the existing grade on undisturbed, natural, sandy gravel existing at the site.

Minimum soil cover above footings for frost protection is 1.4 and 2.1 metres below the finished grade for heated and unheated buildings, respectively.

Footing surfaces should be hand-cleaned to remove all disturbed, loose or wet material. The minimum width of footing that can be used should conform to specifications in the appropriate building code.

Additional recommendations for continuous and/or spread footings are contained in Appendix II of this report.

### 5.2.2 Settlement Evaluation

The recommended design parameters presented in this section are for preliminary design purposes. We believe that compliance with the recommendations would produce tolerable settlement under normal structures.

It should be noted, however, that foundation settlements are a function of the foundation layout and the construction procedure. We recommend that Global Engineering and Testing Ltd. should review the final design of the foundation system prior to construction.

## 5.3 Floor Slabs Supported on Grade

Floor slabs supported on grade must be designed for the intended loads, including those resulting from material storage and the operation of machinery. Proof rolling should be applied to the subgrade to detect any soft subgrade prior to the placing of the granular base course. Any soft, organic and fill materials must be over-excavated and replaced by granular materials. Floor slabs should be supported on a well-compacted granular base to ensure

uniform distribution of floor loadings over the subgrade. The required thickness of this base course is dependent upon the magnitude of the loadings, but should not be less than 150 mm. The base course and any other fill material used to replace soft subsoils should be compacted to at least 98% of standard proctor maximum dry density.

Recommendations pertaining to concrete floor slabs supported on grade are contained in Appendix II.

### 5.4 Subgrade Protection

Subgrade soils beneath foundation elements must be protected from frost penetration during and after construction. Detrimental heaving due to soil freezing and/or settlement resulting from subsequent thawing of frozen soils may result. It is essential to ensure that footings and floor slabs are not placed on frozen subsoils, and that the foundation soils are protected from frost actions at all times.

Similarly, all foundation excavations must be protected from rain, snow and the ingress of free water. Surface ponding should not be allowed on any excavated surfaces. Unnecessary prolonged exposure of bearing surfaces should be avoided to limit effects of weathering and deterioration of the integrity of the subgrade soils.

### 5.5 Lateral Earth Pressure

For walls, well-graded and well-drained granular materials should be used as backfill. The lateral earth pressure on walls can be estimated with the following equation:

$$P = \frac{K\gamma H^2}{2}$$

Where, P = lateral earth pressure force per unit length of wall

$K_o$ = coefficient of at rest earth pressure (0.5)

$K_a$ = coefficient of active earth pressure (use 0.3)

$K_p$ = coefficient of passive earth pressure (use 3.0)

$\gamma$ = unit weight of soil (use 21 kN/m$^3$)

H = wall height

The above expression does not include surcharge and/or hydrostatic loads and these should be added where applicable.

It should be noted that the top 0.6 metres (2 feet) of backfill should consist of relatively impermeable materials (e.g., clayey soil) to prevent surface water infiltration.

Additional recommendation for the drainage material is provided in the Appendix II.

### 5.6 Cement Type

Negligible sulphates were found in the soil samples obtained. Based on the test results, it is recommended that Normal Portland cement be used for concrete foundation elements. A minimum 28 days compressive strength of 25 MPa is recommended. Air entrainment of four to six percent should be used, especially for concrete in contact with soil and exposed to freeze/thaw conditions.

### 5.7 Temporary Excavation Sideslopes, Fill, Backfill and Underground Pipes

Temporary excavations at the site should be sloped or shored for worker and foundation protection. Construction must conform to good practice and comply with regulations, such as the Alberta Construction Safety Regulations. For temporary excavations in the natural soil, existing at the site, a construction side slope of 1.0 vertical to 1.5 horizontal may be

used up to a depth of 3.0 metres (10 feet) under dry conditions. Deeper excavation should be shored or sloped at a flatter angle.

Global Engineering and Testing Ltd should verify any construction sideslope differing from the suggested.

Excavation must be protected from rain, snow or any ingress of free water. Prolonged exposure of excavated areas should be avoided to prevent deterioration of exposed soil with resultant slope instability. Similarly, excavated materials should be stockpiled away from the excavations to avoid any slope instability and to prevent materials from falling back into the excavations. The integrity of any existing adjacent structures should be protected by either underpinning or installing a temporary retaining wall prior to the excavations.

All the underground pipes must be placed on the firm ground. Any soft soil, existing below the pipes, must be over-excavated and replaced with well-compacted pit-run gravel. The subgrade soil and bedding soil beneath the pipes should not be allowed to be frozen. All the fill and backfill material in the trench should be free of organic and frozen soil. All the material for filling and backfilling purposes must be placed in 150-mm lifts and compacted to 98% of standard proctor maximum dry density.

Additional recommendation for the drainage material is provided in the Appendix II.

### 5.8 Pavements

In addition to the subsoil conditions, pavement requirements for truck or car parking area are a function of vehicle loadings and frequency of traffic use. In the absence of any specific design data, the following pavement sections are suggested for parking areas:

| HEAVY TRUCKS | COURSE THICKNESS | |
|---|---|---|
| Asphalt surfaces | 10 cm | 4 inches |
| Crushed gravel base | 5 cm | 2 inches |
| Pit-run gravel sub base (Subgrade compaction 98%) | 25 cm | 10 inches |

| CARS AND LIGHT TRUCKS | COURSE THICKNESS | |
|---|---|---|
| Asphalt surfaces | 5 cm | 2 inches |
| Crushed gravel base | 5 cm | 2 inches |
| Pit-run gravel base (Subgrade compaction 98%) | 20 cm | 8 inches |

Proof rolling should be applied to the subgrade prior to placing base course to detect weak areas. Any organic and soft fill, encountered at the pavement subgrade, should be over-excavated and replaced by granular material compacted to 98% of standard proctor maximum dry density. However, all the crushed gravel base course and pit-run gravel sub base course must be compacted to a minimum 98% of standard proctor maximum dry density.

Additional recommendations for pavements are presented in Appendix II, together with suggested gradation limits for crushed gravel base and pit-run sub base material.

### 5.9 Drainage

Final site grading should direct surface run-off away from the proposed structure to prevent surface water infiltration.

Weeping tile drainage system should not be required for the proposed elevated slab on grade building.

### 5.10 Inspection

It is recommended that Global Engineering and Testing Ltd. be engaged to perform the footing soil inspection or piling installation inspection, and to provide compaction and concrete testing services during the construction stages of this project.

## 6.0 CLOSURE

The recommendations presented in this report were based on interpreted subsurface conditions, found in the three testholes drilled at the site. Additional recommendations contained in Appendix II should be read in conjunction with the text of this report.

It should be noted that the natural conditions can be variable. Individual recommendations in this report should not be used out of context with the entire report, and the interpretation of any part of this report should be made in consultation with our office to avoid any misinterpretation.

Due to the complexity and variability of the subsurface soil existing in the ground, Global Engineering and Testing Ltd. will not be responsible for any consequence in the proposed development as a result of soil problems, if Global Engineering and Testing Ltd. is not called for verification of the subgrade and foundation soil during construction.

Yours respectfully submitted,

**GLOBAL ENGINEERING AND TESTING LTD.**

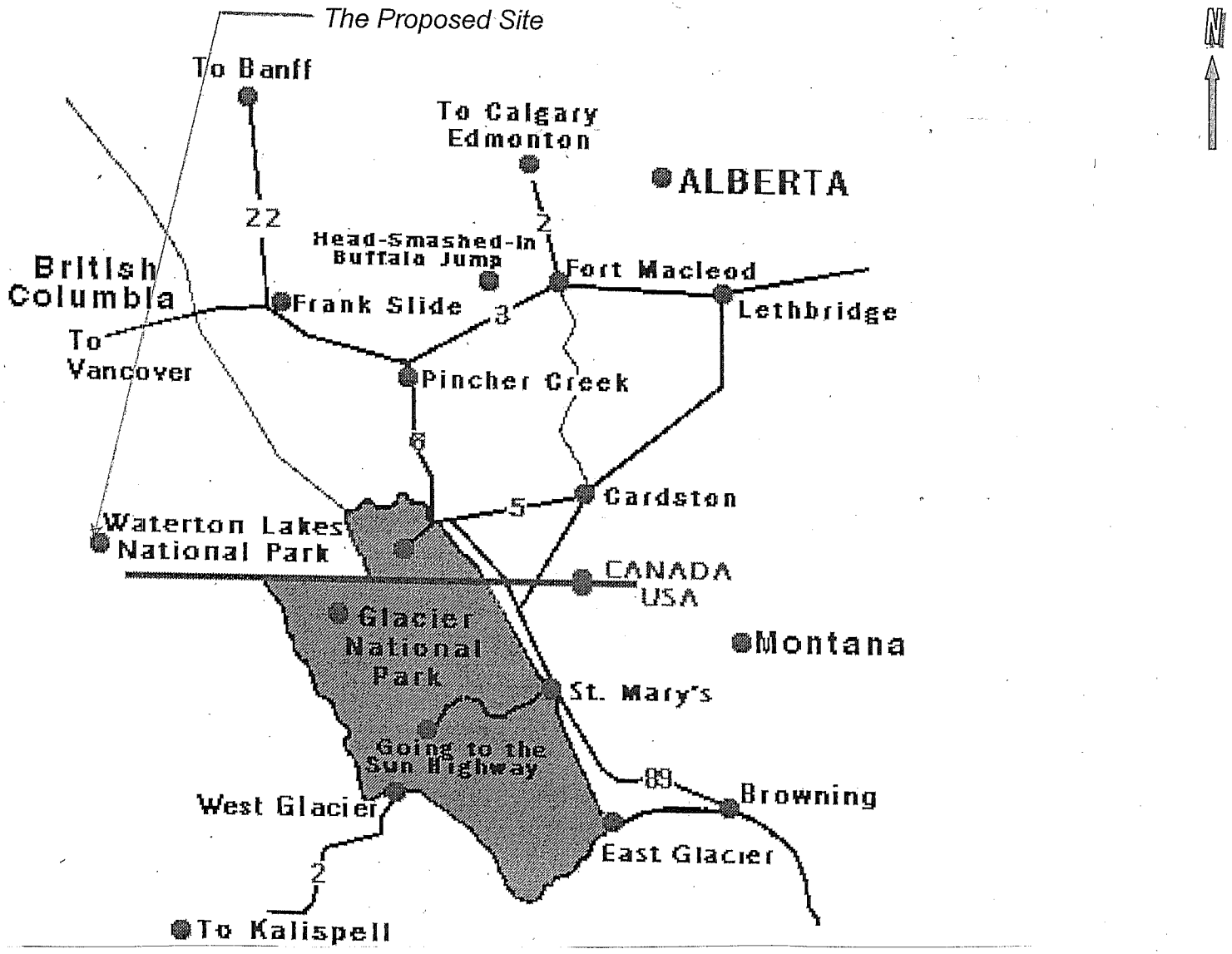
PROFESSIONAL ENGINEER D. T. Pham ALBERTA

PERMIT TO PRACTICE
GLOBAL ENGINEERING AND TESTING LTD
Signature
Date August 19/2008
PERMIT NUMBER: P 4196
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Dong Pham, B.Sc., Dip.En., P.Eng.
Sr. Geotechnial Engineer

DP/mt

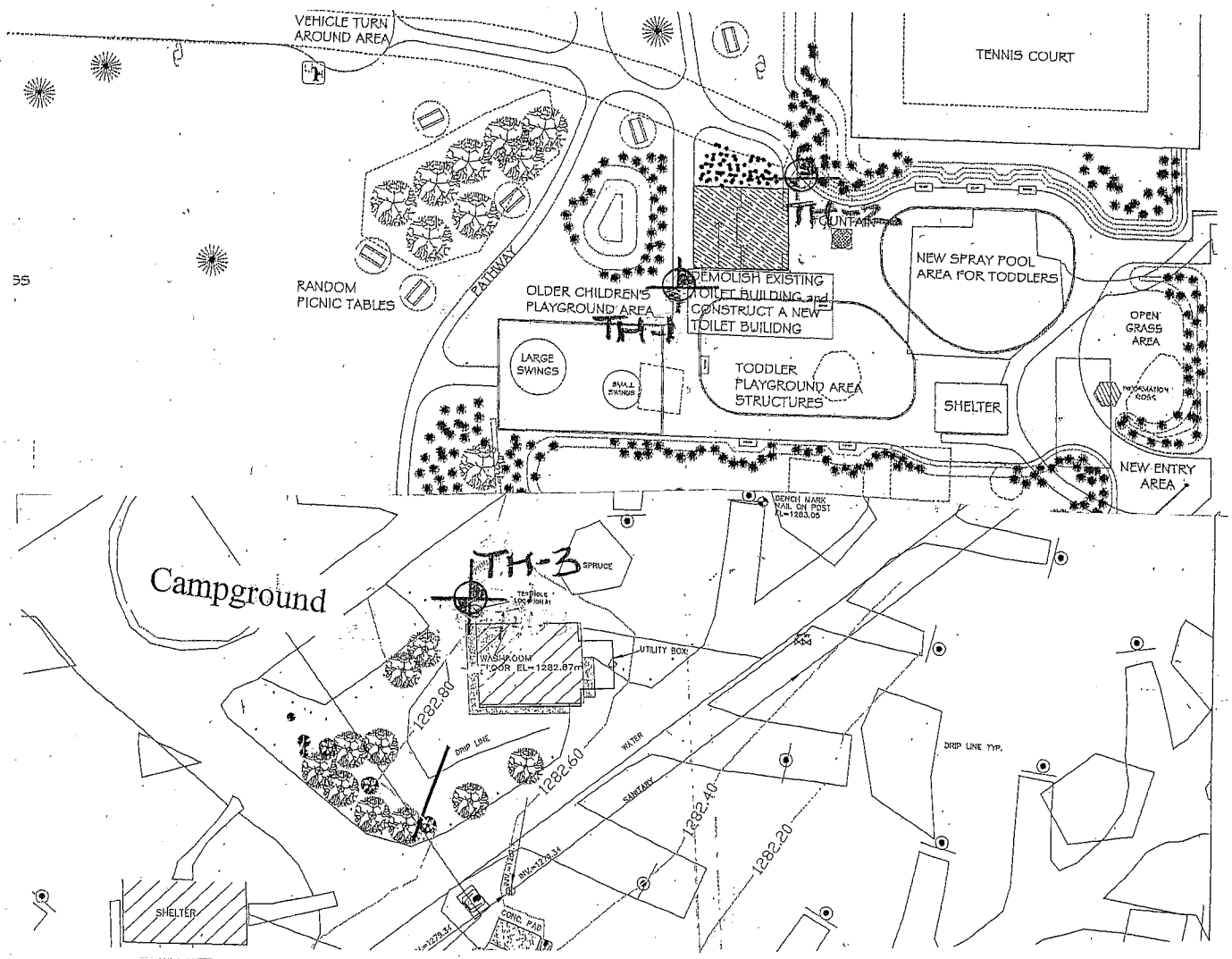
# APPENDIX I




**GLOBAL ENGINEERING AND TESTING LTD.**

| | | | |
|---|---|---|---|
| TITLE: The Site Map For Waterton National Park, Alberta | | | PREPARED BY: ASAD |
| DATE: August 18, 2008 | PROJECT NO.: 082-1589-8 | SCALE: N.T.S | PLATE NO.: I - 1 |

## The Proposed Site




**GLOBAL ENGINEERING AND TESTING LTD.**

| | | | |
|---|---|---|---|
| TITLE: The Site Plan For Waterton National Park, Alberta | | | PREPARED BY: ASAD |
| DATE: August 18, 2008 | PROJECT NO.: 082-1589-8 | SCALE: N.T.S | PLATE NO.: I - 2 |

# EXPLANATIONS OF SOIL DESCRIPTIONS AND SYMBOLS SHOWN ON TESTHOLE LOGS

## 1. DEFINITION OF SOIL TYPES

| Material | Grain Size |
|---|---|
| Boulders | Larger than 200 mm |
| Cobbles | 80 - 200 mm |
| Gravel: Coarse | 20 - 80 mm |
| Fine | 5 - 20 mm |
| Sand: Coarse | 2 - 5 mm |
| Medium | 425 µm - 2 mm |
| Fine | 75 µm - 424 µm |
| Silt and Clay | Smaller than 75 µm |

## 2. COMPOSITION OF SOIL

2.1 Principal component – Major soil type representing at least 50% of weight of material.

2.2 Minor component – Minor soil types identified by the following terms with respect to their percentages by weight of material:

| | |
|---|---|
| "Little" | 10 - 20 % |
| "Trace" | 1 - 10% |
| "And" | 35 - 50% |
| "Some" | 20 - 35% |

## 3. CONSISTENCY OR STRENGTH OF SOIL

3.1 Coarse-grained soils (principal component larger than 75 µm) – The following terms are used relative to the standard penetration test (ASTM D 1586):

| No. of blows per foot | Description |
|---|---|
| Less than 4 | Very Loose |
| 4 - 10 | Loose |
| 10 - 30 | Compact |
| 30 - 50 | Dense |
| Over 50 | Very Dense |

3.2 Fine-grained soils (principal component smaller than 75 µm) – The following terms are used relative to the unconfined compressive strength:

| Unconfined Compressive Strength kPa (tsf) | Description |
|---|---|
| 24 (0.25) | Very soft |
| 24 – 48 (0.25 - 0.5) | Soft |
| 48 – 96 (0.5 - 1.0) | Firm |
| 96 – 190 (1.0 - 2.0) | Stiff |
| 190 – 380 (2.0 - 4.0) | Very Stiff |
| 380 (4.0) | Hard |

## 4. SAMPLE TYPES OF SOIL

| SYMBOL | SAMPLE TYPE |
|---|---|
| ☑ | Undisturbed |
| ☒ | Disturbed |
| ■ | Lost Sample |

| | | |
|---|---|---|
| Project Name: Waterton National Park, AB, | Drilling Contractor : All Service Drilling Inc. | BOREHOLE NO: **TH-1** |
| Client: Zeidler Partnership Architects, | | PROJECT NO: 082-1589-8 |
| | Drilling Method :SS Auger/Track Rig | ELEVATION: Exisitng G/S |

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC — M.C. — LIQUID (20 40 60 80) | ▲ VANE SHEAR (kPa) ▲ 100 200 300 400 / ■ BLOW COUNT ■ 20 40 60 80 / ◆ UNCONF. SHEAR STR. (kPa) ◆ 100 200 300 400 / ● 0.5 x POCKETPEN. (kPa) ● 100 200 300 400 | OTHER DATA | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | TOPSOIL<br>-silty, grass, rootltes, dark brown | | | | | | | |
| | | SANDY GRAVEL<br>-occasional cobbles<br>-some silt<br>-compact to dense<br>-dry to damp<br>-light brown | | S1 | | | | | |
| 1 | | | | | | | | | |
| | | -no silt below 1.52m | | S2 | 12-15-17 | | | | |
| 2 | | | | | | | | | |
| | | | | S3 | | | | | |
| 3 | | | | | | | | | |
| | | | | S4 | 20-21-30 | | | | |
| | | | | S5 | | | | Note: (1). Dynamic cone was conducted below 3.5m due to sloughing<br>(2). Values shown per 300mm | |
| 4 | | | | | 32 | | | | |
| | | | | | 69 | | | | |
| | | -sloughing @ 4.57m | | S6 | 50/5" | | >> | | |
| 5 | | EOH @ 4.88M<br>-satndpipe installed<br>-dry upon completion | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |

| | | |
|---|---|---|
| Global Engineering & Testing Ltd. | LOGGED BY: ASAD | COMPLETION DEPTH: 4.88 m |
| | REVIEWED BY: DP | COMPLETION DATE: 12/8/08 |
| | | Plate. No: I-3 |

| | | |
|---|---|---|
| Project Name: Waterton National Park, AB, | Drilling Contractor : All Service Drilling Inc. | BOREHOLE NO: **TH-2** |
| Client: Zeidler Partnership Architects, | | PROJECT NO: 082-1589-8 |
| | Drilling Method :SS Auger/Track Rig | ELEVATION: Exisitng G/S |

SAMPLE TYPE: SHELBY TUBE, CORE SAMPLE, SPT SAMPLE, GRAB SAMPLE, NO RECOVERY

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | OTHER DATA | Elevation (m) |
|---|---|---|---|---|---|---|---|
| 0 | | TOPSOIL<br>-silty, some gravel<br>-organics, grass, rootlets<br>-dark brown | | | | | |
| | | SANDY GRAVEL<br>-occasional cobbles, some silt<br>-compact to dense<br>-dry to damp<br>-brown | | S1 | | | |
| 1 | | | | S2 | 10-9-17 | | |
| | | -no silt below 1.83m | | | | | |
| 2 | | | | S3 | | | |
| 3 | | | | S4 | 20-19-21 | | |
| | | -more sloughing below 3.6m | | S5 | | Note: (1). Dynamic cone was conducted below 3.5m due to sloughing<br>(2). Values shown per 300mm | |
| 4 | | | | | 59 | | |
| | | -bouncing of dynamic cone on boulder | | | 30/3" | >> | |
| | | EOH @ 4.57M<br>-dry upon completion | | S6 | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |

PLASTIC — M.C. — LIQUID (20 40 60 80)

▲ VANE SHEAR (kPa) ▲ 100 200 300 400

■ BLOW COUNT ■ 20 40 60 80

◆ UNCONF. SHEAR STR. (kPa) ◆ 100 200 300 400

● 0.5 x POCKETPEN. (kPa) ● 100 200 300 400

| | | |
|---|---|---|
| Global Engineering & Testing Ltd. | LOGGED BY: ASAD | COMPLETION DEPTH: 4.57 m |
| | REVIEWED BY: DP | COMPLETION DATE: 12/8/08 |
| | | Plate. No: I-4 |

| | | |
|---|---|---|
| Project Name: Waterton National Park, AB, | Drilling Contractor : All Service Drilling Inc. | BOREHOLE NO: **TH-3** |
| Client: Zeidler Partnership Architects, | | PROJECT NO: 082-1589-8 |
| | Drilling Method :SS Auger/Track Rig | ELEVATION: Exisitng G/S |

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC M.C. LIQUID (20 40 60 80) | ▲ VANE SHEAR (kPa) ▲ 100 200 300 400 / ■ BLOW COUNT ■ 20 40 60 80 / ◆ UNCONF. SHEAR STR. (kPa) ◆ 100 200 300 400 / ● 0.5 x POCKETPEN. (kPa) ● 100 200 300 400 | OTHER DATA | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | TOPSOIL<br>-silty, grass, rootlets, dark brown | | | | | | | |
| | | SANDY GRAVEL<br>-some silt, occasional cobbles<br>-compact to dense<br>-dry to damp<br>-dark brown to brown | | S1 | | | | | |
| 1 | | | | | | | | | |
| | | -no silt below 1.52m | | S2 | 12-15-17 | | ■ | | |
| 2 | | | | | | | | | |
| | | -sloughing below 2.3m and dynamic cone was conducted | | S3 | 41 | | ■ | Note: (1). Dynamic cone was conducted below 3.5m due to sloughing<br>(2). Values shown per 300mm | |
| | | | | | 64 | | ■ | | |
| | | | | | 69 | | ■ | | |
| 3 | | | | S4 | 82 | | ■ | | |
| | | | | | 90/10" | | >>■ | | |
| | | EOH @ 3.66M<br>-dry upon completion<br>-backfilled properly | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |

| | | |
|---|---|---|
| Global Engineering & Testing Ltd. | LOGGED BY: ASAD | COMPLETION DEPTH: 3.66 m |
| | REVIEWED BY: DP | COMPLETION DATE: 12/8/08 |
| | | Plate. No: I-5 |

## GENERAL CONDITIONS

This geotechnical investigation pertains to a specific site and development described in the introduction of the report. It may not be applicable in full to other types of development or modifications to the original proposed development.

It is not valid for other sites. Developments, which may influence soil structure interaction, should undergo a geotechnical review in order to determine the validity of the design concepts untilized.

The soils encountered have been visually classified by methods accepted in professional geotechnical practice. Identification of geological units is judgmental in nature as to both type and condition. Global Engineering and Testing Ltd. does not warrant that the soils represented herein are exact, but infers accuracy only to the extent that is common in geotechnical practice. The boring logs are compiled from field classification and test data. The interpreted geological strata, indicated by a line on the logs, are in fact often a gradual transition.

In general, the stratigraphy is known only at the boring. The actual stratigraphy may vary between boreholes as is inherent in all geological formations. Caution in interpolation between boreholes is required.

Because of the nature of geological deposits, soil conditions can be materially altered by construction procedures and environmental changes. Should construction procedures cause reworking, stress changes or exposure to changed environment, a geotechnical engineer should carry out an additional investigation. These investigations then may serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein for the benefit of the project.

## FOOTINGS

Footings should be founded on undisturbed, native, inorganic soil with the required bearing capacity. Weak or soft foundation soils may exist at the site that is not encountered in the test borings. Over-excavation below footing levels may be required to ensure that footings are founded on competent bearing strata. Global Engineering and Testing Ltd. should inspect all footing excavations prior to concreting.

All loose, disturbed material should be removed from bearing surfaces of footing excavations. Hand cleaning will be required if acceptable bearing surfaces cannot be prepared by machines.

Footing excavation should be protected from rain, snow, drying and ingress of free water at all times. Prolonged exposure of the foundation excavations should be avoided.

Foundation soils beneath footings must be protected from frost action during and after construction. Adequate frost protection should be provided to all footings. Footings in heated areas should be founded at a depth of at least 1.37 metres (4.5 feet) below final grade. Footings in unheated areas should have a minimum soil cover of 2.13 metres (7 feet).

Footings and foundation walls should be adequately reinforced to tolerate a reasonable amount of differential foundation movement. If grade beams are used, a void space or a layer of compressible material should be placed between grade beams and the ground surface to limit any heaving pressures resulting from soil expansion.

Backfill around foundation walls and grade beams should consist of inorganic soils. Backfill should not be placed until the concrete foundation elements have developed sufficient strength and are laterally supported to resist earth pressure. The use of heavy equipment for compaction should be avoided. Backfill should be compacted in layers not exceeding 0.15 metres (6 inches) in compacted thickness, and should be compacted to a uniform dry density of 98% standard proctor maximum dry density. The backfill material should be capped with a minimum of 0.6 metres of compacted and impermeable soils to minimize surface water infiltration. The final site grading should be sloped away from the building walls.

## FLOOR SLAB-ON-GRADE

Proof rolling must be applied on the subgrade prior to placing base course to detect weak subgrade soil. All topsoil and soils containing organic material should be removed from beneath slab areas. In addition, soft or weak areas should be over-excavated to competent material. The final grade can be restored to its intended level with well-compacted backfill materials.

Locally derived inorganic soils or granular soils may be approved for backfill. The backfill materials should be compacted in 0.15-metre (6-inch) lifts to a uniform dry density of 98% standard proctor maximum dry density.

A well-graded granular base should be provided directly beneath floor slabs. The use of large size gravel should be avoided to limit potential stress concentration under floor slabs. Frost and ice lenses should not be allowed to occur in the subgrade soil before and after the completion of the floor slab.

It is recommended that the floor slabs should contain an adequate number of construction and expansion joints to ensure controlled cracking of concrete. Also, slabs may be structurally separated from foundation elements to allow uniform settlement. Slabs, supporting dynamic loading, should be specially designed.

## ASPHALT PAVEMENTS

All topsoil and soils containing organic material should be stripped to native materials, proof rolling should be applied to the subgrade soil prior to placing base course to detect any weak subgrade soil. All soft or weak areas should be over-excavated and backfilled with well-compacted, inorganic soils. Alternatively, suitable filter cloth may be used to increase the strength of the subgrade. However, it must be utilized under the supervision of a qualified geotechnical engineer.

Frost and ice lenses should not be allowed to exist in the subgrade prior to placing the base course and asphalt. Otherwise, settlement and cracks may be resulting in the pavement structure.

All backfill and base course materials should be compacted in layers not exceeding 0.15 metres (6 inches) in compacted thickness and should be compacted to a uniform dry density of 98% standard proctor maximum dry density.

Adequate surface drainage of paved areas is essential to the performance of the pavement structure. Surface ponding should be avoided and a minimum surface gradient of 1.5% is recommended.

All the base course and asphalt material should meet the project specifications and the requirements of the City of Calgary. The pavement compaction and construction procedures should also follow the above requirements.

# RECOMMENDED GRADATION LIMITS FOR CRUSHED GRANULAR BASE COURSE MATERIALS

| NOMINAL GRAVEL SIZE | Pit Run | 112 mm | 56 mm | 28 mm |
|---|---|---|---|---|
| Sieve Size | Percent Passing by Weight | | | |
| 224 mm | 100* | | | |
| 160 mm | 80 – 96* | | | |
| 112 mm | | 100 | | |
| 80 mm | 60 – 80 | 90 – 100 | | |
| 56 mm | | | 100 | |
| 40 mm | | 60 – 80 | 90 – 100 | |
| 28 mm | 60 – 100** | | | 100 |
| 20 mm | | 40 – 65 | 50 – 75 | 95 - 100 |
| 14 mm | | | | |
| 10 mm | | 25 – 48 | 25 – 52 | 60 – 80 |
| 5 mm | 25 – 45** | 15 – 35 | 20 – 40 | 40 – 60 |
| 2.5 mm | | 10 – 30 | 12 – 26 | 28 – 48 |
| 1.25 mm | 16 – 25** | | | |
| 630 µm | 8 – 18** | 6 – 18 | 4 – 13 | 13 – 29 |
| 315 µm | | | | 9 – 21 |
| 160 µm | 4 – 10** | 3 – 10 | 2 – 7 | 6 – 15 |
| 80 µm | 2 – 6** | 2 – 8 | 1 – 6 | 4 - 10 |

**NOTE:** * Percent by weight on total sample.
** Percent by weight on sample material passing 80 mm sieve.

## RECOMMENDED GRADATION LIMITS FOR BEDDING AND DRAINAGE MATERIALS

| NOMINAL GRAVEL SIZE | 56 mm | 40 mm | Sand |
|---|---|---|---|
| Sieve Size | Percent Passing by Weight | | |
| 80 mm | | | |
| 56 mm | 100 | | |
| 40 mm | 90 – 100 | 100 | |
| 28 mm | | 95 - 100 | |
| 20 mm | 35 - 70 | | |
| 14 mm | | 25 - 60 | |
| 10 mm | 10 - 30 | | 100 |
| 5 mm | 0 - 5 | 0 - 10 | 95 - 100 |
| 2.5 mm | | 0 - 5 | 80 - 100 |
| 1.25 mm | | | 50 - 85 |
| 630 µm | | | 25 - 60 |
| 315 µm | | | 10 - 30 |
| 160 µm | | | 2 - 10 |
| 80 µm | | | |

July 21, 2015

Amec Foster Wheeler File: LT154508

Public Works and Government Services Canada
1650, 635 - 8th Avenue, SW
Calgary, Alberta T2P 3M3

**Attention: Mr. Mark Burke, P.Eng.**
**Project Manager, Southern Alberta**

**RE: GEOTECHNICAL INVESTIGATION**
**Proposed Utility Replacements & Surfacing Upgrades**
**Waterton Lakes National Park (Townsite), Alberta**

## 1.0 INTRODUCTION

At the request of Public Works and Government Services Canada, Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) has carried out a geotechnical investigation to support the design and construction of proposed watermain, sanitary sewer and surfacing upgrades along the following streets in Waterton, Alberta:

- Evergreen Avenue;
- Columbine Avenue;
- Fern Street;
- Firgrove Street;
- Waterton Avenue; and
- A watermain along the west side of Cameron Creek.

In addition to installation of pipes for underground utility replacement, it is understood that a lift station is proposed near the south end of Evergreen Avenue (near TP15-06), and that the lift station will extend to a depth of about 4 m below grade.

This report summarizes the results of the field work and laboratory testing, and provides geotechnical discussion and recommendations to support the proposed project.

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## 2.0 METHODOLOGY AND RESULTS

### 2.1 Methodology

In order to assess the subsurface soil and groundwater conditions at the various streets indicated, Amec Foster Wheeler visited the sites on June 10, 2015 and monitored the excavation of a series of seven test pits. The test pits were excavated at the locations denoted on Figure 1 as TP15-01 to TP15-07, inclusive, at generally the following locations.

- TP15-02, TP15-05 and TP15-06 were excavated along Evergreen Avenue;
- TP15-01 was excavated along Fern Street just east of Evergreen Avenue;
- TP15-03 was excavated along Columbine Avenue just east of Evergreen Avenue;
- TP15-04 was excavated adjacent to Cameron Creek just north of Columbine Avenue;
- TP15-07 was excavated along Waterton Avenue just south of the trailer park.

The test pits were excavated using a John Deere 410J Loader/Backhoe operated by Biantco Environmental Services, and extended to depths ranging between about 2.7 m and 3.0 m below existing grade. During the excavations, representative samples of the subsurface strata were recovered from the excavated material. Upon completion of the excavations, the test pits were backfilled with the excavated material.

The test pit excavations were carried out under the supervision of an Amec Foster Wheeler technician, who collected the soil samples and logged the subsurface conditions. The recovered soil samples were transported to Amec Foster Wheeler's Lethbridge laboratory for further review by a geotechnical engineer and selected laboratory classification testing. Laboratory testing for this project consisted of routine moisture content determinations, with results presented on the attached Test Pit Summary Table.

Samples remaining will be stored for a period of three months following issuance of this report at which time they will be discarded unless we are requested otherwise by the Client.

## 2.2 Soil and Groundwater Conditions

The subsurface conditions encountered are detailed on the attached Test Pit Summary Table and summarized in the following paragraphs.

*Pavement Structure*

The test pits advanced in pavement areas were generally surfaced with a 100 mm thick layer of asphalt. At these locations, the asphalt was generally underlain by a thin layer (100 mm to 200 mm) of crushed gravel.

*Topsoil*

TP15-04 and TP15-06 were both surfaced with a 150 mm thick layer of topsoil.

*Sand and Gravel*

The predominant natural mineral soil encountered in each of the test pits was gravel. The gravel was described as sandy with occasional cobbles and boulders, brown, and compact (based on tactile observations and observed excavation resistance). At TP15-01, some shale layering was observed below about 1.5 m depth.

Based on laboratory testing, the *in situ* water content of the gravel ranged between about 1 percent and 8 percent, generally indicative of damp to very moist soil conditions.

To further assess the sand and gravel, a sample from TP15-06 was subjected to a laboratory grain size analysis. The results are presented on Figure 2. It is noted that material larger than about 40 mm was not collected as part of the field sampling.

*Sloughing and Groundwater Conditions*

During the test pit excavations, some sloughing of the vertical test pit walls was observed in about half of the test pits, generally below about depth of 1.5 m.

The test pits were generally dry upon completion of the excavation, with the exception of TP15-06 where rapid groundwater recovery was observed to a depth of about 1.75 m below grade. It is noted that the groundwater conditions are expected to fluctuate seasonally in response to spring thaw and periods of heavy precipitation, and may differ at the time of construction.

## 3.0 GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

As indicated previously, it is understood that watermain, sanitary sewer and surface upgrades are proposed along the following streets in Waterton:

- Evergreen Avenue;
- Columbine Avenue;
- Fern Street;
- Firgrove Street;
- Waterton Avenue; and
- A watermain along the west side of Cameron Creek.

In addition to installation of pipes for underground utility replacement, it is understood that a lift station is proposed near the south end of Evergreen Avenue (near TP15-06), and that the lift station will extend to a depth of about 4 m below grade.

It is anticipated that the underground utility pipe installation will be by conventional open cut.

In general, the existing soil and groundwater conditions along the subject streets will support conventional open cut construction for the proposed pipe installation. However, some challenging conditions will be encountered near the south end of Evergreen Avenue where free groundwater was encountered below about 1.7 m depth.

Based on our understanding of the proposed development as discussed above in conjunction with the results of the current investigation, the following paragraphs provide geotechnical discussion and recommendations pertaining to site preparation, excavations, frost protection requirements, roadway reconstruction, and pavement construction.

### 3.1 Excavations and Dewatering

All excavations should conform to Part 32 of the 2009 Alberta Occupational Health and Safety Code.

Where spatial restrictions do not allow for the required safe trench sideslope inclinations, conventional shoring (i.e., trench boxes) can be considered. For shoring design, the following parameters can be used for the upper fill and native soils:

**Table 1: Parameters for Shoring Design**

| Parameter | Natural Sand & Gravel Soils |
|---|---|
| Total Unit Weight, $\gamma$, kN/m³ | 22 |
| Active Earth Pressure Coefficient, $k_a$ | 0.29 |

The weight of the adjacent structures must also be considered in the calculation of the lateral earth pressures where these structures fall within a line drawn up at 45° from the base of the excavations. Where trench boxes or shoring are used, adjacent structures should be inspected prior to and following construction to ensure damage has not occurred to the foundations.

Based on the results of the investigation, groundwater accumulation is not generally anticipated within service trenches above 3.0 m depth, with the exception of the south end of Evergreen Ave (the proposed lift station) where groundwater was encountered at about 1.7 m depth (TP15-06).

While minor groundwater accumulations within the services trenches can likely be accommodated by conventional sump pumping techniques, more extensive dewatering measures, such as the use of well points, will likely be required at the proposed lift station in order to facilitate an excavation to install the lift station.

### 3.2 Proposed Lift Station

As indicated above, more extensive dewatering measures will likely be required to achieve a successful excavation for the proposed lift station. In order to assist in assessing the permeability of the sand and gravel for design of a dewatering system, a laboratory grain size analysis was carried out on a sample of the sand and gravel from the lower portion of TP15-06. The results of the grain size analysis indicate a permeability in the order of 1 cm/sec.

The natural on-site excavated sand and gravel can be generally used as backfill for the lift station, provided the material is screened of boulders larger than about 150 mm, and moisture conditioned to within three percent of the optimum moisture content as determined by the Standard Proctor test. In this regard, some moisture conditioning of the soils should be anticipated. The backfill should be placed in maximum 300 mm thick lifts, and compacted to at least 98 percent of SPMDD.

The lift station will also need to be designed to withstand uplift by buoyancy (groundwater) forces. In this regard, the design groundwater depth should be taken as 0.5 m below grade. Typically, the uplift forces on the lift station would be resisted by the dead weight of the structure, the dead weight of a base slab which extends out beyond the edges of the lift station, and the weight of backfill soils over the lateral protrusion of the base slab beyond the edge of the lift station. Where the natural sand and gravel soils are used as backfill around the structure, a unit weight of 22 $kN/m^3$ can be used for the sand and gravel, with an effective unit weight of 12 $kN/m^3$ below the design water table.

### 3.3 Service Construction and Backfill

Bearing problems are not anticipated for pipes founded on the natural sand and gravel deposits.

The trenches above the service pipes should be backfilled with inorganic on-site soils placed in maximum 300 mm thick lifts and compacted to at least 98 percent of SPMDD. Bedding sand or gravel will be required for the pipe installations in accordance with the manufacturer's recommendations.

The natural on-site excavated sand and gravel can be generally used as trench backfill, provided the material is screened of boulders larger than about 150 mm, and moisture conditioned to within three percent of the optimum moisture content as determined by the Standard Proctor test. In this regard, some moisture conditioning of the soils should be anticipated.

### 3.4 Roadway Reconstruction

It is understood that the excavations will generally encompass the full width of the various roadways. Accordingly, full width reconstruction of the roadway has been indicated.

Prior to placement of granular fill or asphalt, areas to be paved should be stripped of all existing deleterious material, scarified and moisture conditioned to 300 mm depth, and be recompacted to a minimum of 98 percent of SPMDD at a moisture content within two percent of optimum. Any soft spots revealed by this or any other observations should be over-excavated and backfilled with approved material.

Provided the preceding recommendations are followed, the pavement thickness design requirements given in the following table are recommended for the anticipated traffic loading and subgrade conditions.

**Table 2: Recommended Pavement Structure Thicknesses**

| Pavement Layer | Compaction Requirements | Medium Duty Pavement Structure Thicknesses |
|---|---|---|
| Asphaltic Concrete | 93% Maximum Theoretical Density | 100 mm Type III* |
| Granular Base Course* | 100% SPMDD | 75 mm |
| Reclaimed asphalt* | 100% SPMDD | 75 mm |
| *Notes: | * City of Lethbridge Specification<br>* The reclaimed asphalt (millings) should be well graded with a maximum size of 25 mm.<br>The subgrade must be moisture conditioned to a depth of 300 mm and compacted to 98% SPMDD. | |

The recommended pavement structure provided in the above table is based on the natural subgrade soil properties determined from visual examination and textural classification of the soil samples. Consequently, the recommended pavement structures should be considered for preliminary design purposes only, and should be verified during construction based on actual site subgrade conditions.

If construction is undertaken under adverse weather conditions (i.e., wet or freezing conditions) subgrade preparation and granular base requirements should be reviewed by the geotechnical engineer. As well, if only a portion of the pavement will be in place during construction, the granular base may have to be thickened, and/or the subgrade improved with a geotextile separator.

Samples of both the granular base aggregates and asphaltic concrete paving materials should be checked for conformance to the City of Lethbridge specifications prior to use on site, and during construction.

Good drainage provisions will optimize pavement performance. The pavement subgrade and the finished pavement surface should be free of depressions and should be sloped (preferably at a minimum grade of two percent) to provide effective surface drainage toward catchbasins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas.

A program of in situ density testing must be carried out to verify that satisfactory levels of compaction are being achieved.

## 4.0 CLOSURE

The recommendations given in the above sections are based upon interpreted conditions found within the seven test pits excavated at this site. Should subsurface conditions other than those presented in this report be encountered during construction, the Client should notify our office so that these recommendations can be reviewed.

Soil conditions, by their nature, can be highly variable across a site. A contingency should be included in the construction budget to allow for the possibility of variations in soil conditions, which may result in modification of the design, and/or changes in the construction procedures.

Amec Foster Wheeler requests the opportunity to review the design drawings and the installation of the foundations (lift station) to confirm that the recommendations in this report have been correctly interpreted and implemented. If not afforded the opportunity to conduct this review, Amec Foster Wheeler will not accept responsibility for the interpretation of this report. Amec Foster Wheeler would be pleased to provide any further information that may be needed during design and to advise on the geotechnical aspects of specifications for inclusion in contract documents.

This report has been prepared for the exclusive use of Public Works and Government Services Canada and their designers for the specific application to the development described in this report. Any use that a third party makes of this report, or any reliance or decisions based on this report are the sole responsibility of those parties. This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

Yours truly,

**Amec Foster Wheeler Environment & Infrastructure**
**A division of Amec Foster Wheeler Americas Ltd.**

PROFESSIONAL ENGINEER JOHN LOBBEZOO ALBERTA

July 21/15

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**APEGA PERMIT P04546**

Attachments: Figure 1: Test Pit Location Plan
Figure 2: Grain Size Analysis
Test Pit Summary Table
Explanation of Symbols and Terms

| | | | | |
|---|---|---|---|---|
| Amec Foster Wheeler Environment & Infrastructure<br>469 - 40th Street South<br>Lethbridge, Alberta CANADA T1J 4M1<br>Tel. (403) 327-7474<br>Fax (403) 327-7682 | amec foster wheeler | Public Works and Government Services Canada | | |
| TITLE: TEST PIT LOCATION PLAN | | DWN BY: BJ | DATUM: NA | DATE: JUNE 2015 |
| PROJECT: Proposed Utilities Replacement & Surface Upgrades<br>Waterton Townsite Streetworks<br>Waterton Lakes National Park, Alberta | | CHK'D BY: JS<br>SCALE: NTS | PROJECT NO: LT154508 | FIGURE 1 |

# GRAIN SIZE DISTRIBUTION

**Amec File:** LT154508
**Project:** Waterton Service Upgrades

469, 40th Street South
Lethbridge, Alberta
Canada, T1J 4M1

**Location:** TP15-06 - S3
2.25m Depth

**Date Sampled:** 10-Jun-15

| SIEVE SIZE (um) | PERCENT PASSING |
|---|---|
| | |
| 40 000 | 100 |
| 25 000 | 80 |
| 20 000 | 69 |
| 16 000 | 65 |
| 10 000 | 53 |
| 5 000 | 38 |
| 2 500 | 26 |
| 1 250 | 17 |
| 630 | 9 |
| 315 | 5 |
| 160 | 3.2 |
| 80 | 2.6 |

Notes:
*Material larger than 40mm screened off during field sampling*

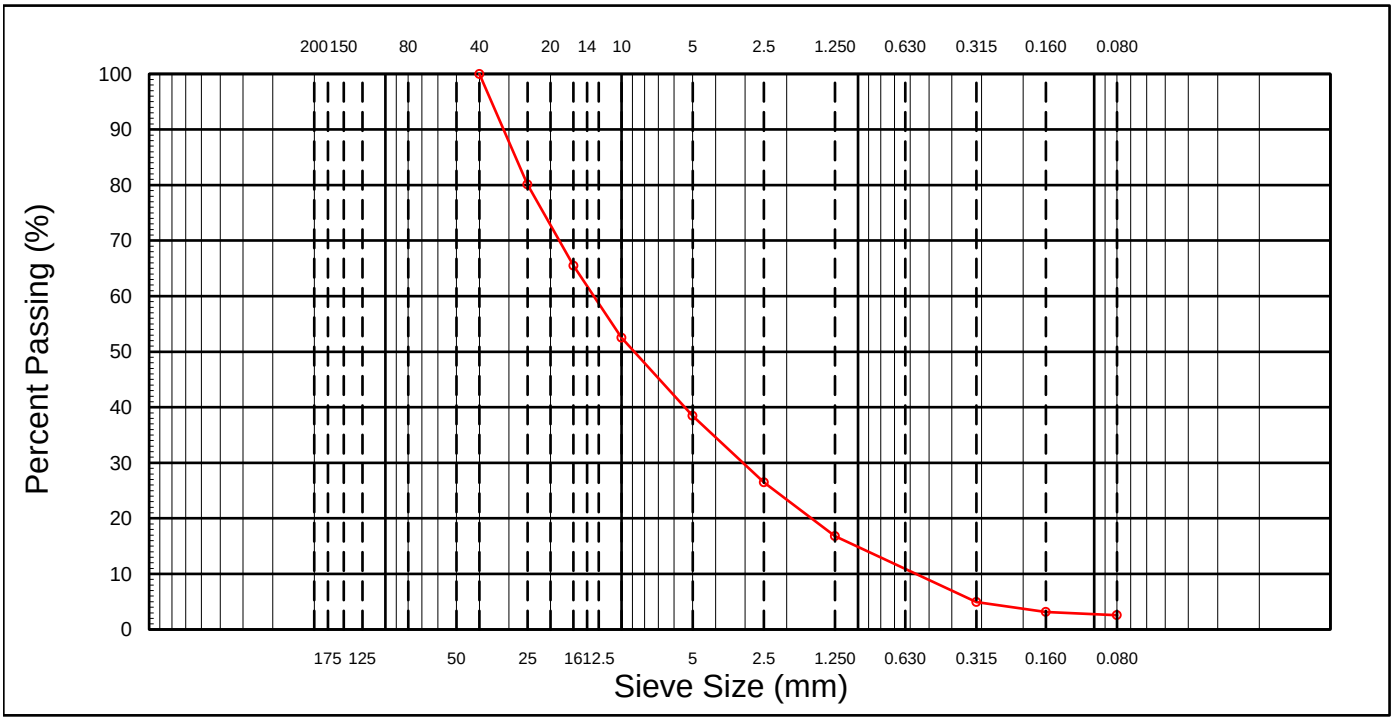



Figure 2

# TEST PIT SUMMARY TABLE

Amec Foster Wheeler File: LT154508
Public Works and Government Services Canada
Proposed Utilities Replacement & Surface Upgrades, Waterton Lakes National Park, Alberta

| TP15-01 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 2.7 | **SAND & GRAVEL –** occasional cobbles and boulders, compact, brown, moist | *0.75m depth:*<br>Moisture: 2.5% |
| 1.5 – 2.7 | … moist to very moist, shale layers | *1.5m depth:*<br>Moisture: 7.4% |
| 2.7 | **End of Test Pit at 2.7 m depth**<br>*-sloughing below 1.5 m depth.*<br>*-test pit backfilled with excavated material.* | *2.25m depth:*<br>Moisture: % |

| TP15-02 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 3.0 | **SAND & GRAVEL –** occasional cobbles and boulders, compact, brown, moist | *0.75m depth:*<br>Moisture: 2.2% |
| 1.5 – 3.0 | … moist to very moist | *1.5m depth:*<br>Moisture: 2.5% |
| 3.0 | **End of Test Pit at 3.0 m depth**<br>*-sloughing below 1.5 m depth.*<br>*-test pit backfilled with excavated material.* | *2.25m depth:*<br>Moisture: 3.9% |

| TP15-03 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 0.1 | **ASPHALT** | |
| 0.1 – 0.2 | **GRAVEL FILL** | *0.75m depth:*<br>Moisture: 3.6% |
| 0.2 – 3.0 | **SAND & GRAVEL –**occasional cobbles and boulders, compact, brown, moist | *1.5m depth:*<br>Moisture: 1.4% |
| 3.0 | **End of Test Pit at 3.0 m depth**<br>*-dry and open upon completion of excavation.*<br>*-test pit backfilled with excavated material.* | *2.25m depth:*<br>Moisture: 0.7% |

| TP15-04 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 0.15 | **TOPSOIL** | *0.75m depth:*<br>Moisture: 1.5% |
| 0.15 – 3.0 | **SAND & GRAVEL –** occasional cobbles and boulders, compact, brown, moist | *1.5m depth:*<br>Moisture: 1.9% |
| 3.0 | **End of Test Pit at 3.0 m depth**<br>*-dry and open upon completion of excavation.*<br>*-test pit backfilled with excavated material.* | *2.25m depth:*<br>Moisture: 1.4% |

| TP15-05 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 0.1 | **ASPHALT** | |
| 0.1 – 0.3 | **GRAVEL FILL** | *0.75m depth:*<br>Moisture: 2.2% |
| 0.3 – 2.7 | **SAND & GRAVEL –** occasional cobbles and boulders, compact, brown, moist | *1.5m depth:*<br>Moisture: 3.2% |
| 1.5 | …moist to very moist | *2.25m depth:*<br>Moisture: 3.0% |
| 2.7 | **End of Test Pit at 2.7 m depth**<br>*-sloughing below 1.9 m depth.*<br>*-test pit backfilled with excavated material.* | |

| TP15-06 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 0.15 | **TOPSOIL** | *0.75m depth:* Moisture: 8.5% |
| 0.15 – 3.0 | **SAND & GRAVEL –** occasional cobbles and boulders, compact, brown, moist | *1.5m depth:* Moisture: 6.3% |
| 1.75 | … free water, hole filled with water from 1.75 m to 3.0 m depth | *2.25m depth:* Moisture: 6.3% |
| 3.0 | **End of Test Pit at 3.0 m depth**<br>*-excessive seepage and sloughing below 1.75 m depth.*<br>*-test pit backfilled with excavated material.* | |

| TP15-07 | | |
|---|---|---|
| *Depth:*<br><br>0.0 – 3.0<br><br>3.0 | <br><br>**SAND & GRAVEL –** occasional cobbles and boulders, compact, brown, moist<br><br>**End of Test Pit at 2.7 m depth**<br>*-dry and open upon completion of excavation.*<br>*-test pit backfilled with excavated material.* | *0.75m depth:*<br>Moisture: 3.6%<br><br>*1.5m depth:*<br>Moisture: 5.5%<br><br>*2.25m depth:*<br>Moisture: 2.0% |

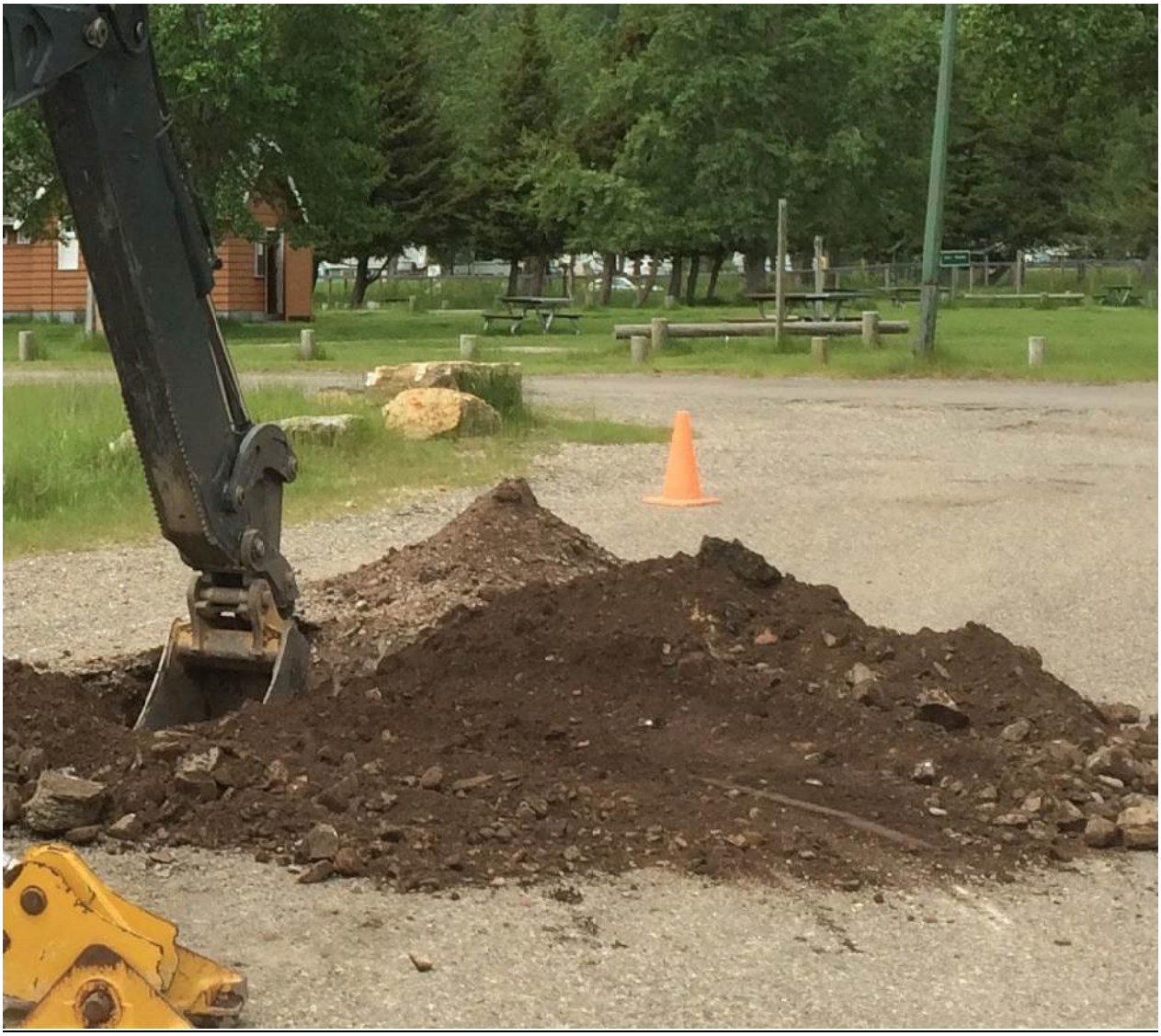


*Table Notes:*
-test pit information to be read in conjunction with Amec Foster Wheeler report LT154508.
-test pits excavated on June 10, 2015 using a John Deere 410J Loader/.
-see Figure 1 for test pit locations

Site Plan & TP Loss

2

TP15-02
Cameron Creek
Northland Lodge
TP15-04
TP15-03
Evergreen Ave
Anemone Rd
Cameron Creek
Townsite Campgr

N

Townsite Campground
Waterton Ave
Cameron Creek
Cameron Creek
Waterton Ave
TP15-05
TP15-06
TP15-07

N

# TEST PIT SUMMARY TABLE

Amec Foster Wheeler File: LT154508
Public Works and Government Services Canada
Proposed Utilities Replacement & Surface Upgrades, Waterton Lakes National Park, Alberta

| TP15-01 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 2.7 | **GRAVEL –** medium grained, trace boulders, trace cobbles, compact, brown, moist | *0.75m depth:*<br>Moisture: 2.5% |
| 1.5 – 2.7 | … moist to very moist, shale layers | *1.5m depth:*<br>Moisture: 7.4% |
| 2.7 | **End of Test Pit at 2.7 m depth**<br>*-sloughing below 1.5 m depth.*<br>*-test pit backfilled with excavated material.* | *2.25m depth:*<br>Moisture: % |

| TP15-02 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 3.0 | **GRAVEL –** medium grained, trace boulders, trace cobbles, sand, compact, brown, moist | *0.75m depth:*<br>Moisture: 2.2% |
| 1.5 – 3.0 | … moist to very moist | *1.5m depth:*<br>Moisture: 2.5% |
| 3.0 | **End of Test Pit at 3.0 m depth**<br>*-sloughing below 1.5 m depth.*<br>*-test pit backfilled with excavated material.* | *2.25m depth:*<br>Moisture: 3.9% |

| TP15-03 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 0.1 | **ASPHALT** | |
| 0.1 – 0.2 | **GRAVEL** | *0.75m depth:*<br>Moisture: 3.6% |
| 0.2 – 3.0 | **GRAVEL –** medium grained, trace boulders, trace cobbles, sandy, compact, brown, moist | *1.5m depth:*<br>Moisture: 1.4% |
| 3.0 | **End of Test Pit at 3.0 m depth**<br>*-dry and open upon completion of excavation.*<br>*-test pit backfilled with excavated material.* | *2.25m depth:*<br>Moisture: 0.7% |

| TP15-04 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 0.15 | **TOPSOIL** | *0.75m depth:*<br>Moisture: 1.5% |
| 0.15 – 3.0 | **GRAVEL –** medium grained, trace boulders, trace cobbles, sandy, compact, brown, moist | *1.5m depth:*<br>Moisture: 1.9% |
| 3.0 | **End of Test Pit at 3.0 m depth**<br>*-dry and open upon completion of excavation.*<br>*-test pit backfilled with excavated material.* | *2.25m depth:*<br>Moisture: 1.4% |

| TP15-05 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 0.1 | **ASPHALT** | |
| 0.1 – 0.3 | **GRAVEL** | *0.75m depth:*<br>Moisture: 2.2% |
| 0.3 – 2.7 | **GRAVEL –** medium grained, trace boulders, trace cobbles, sandy, compact, brown, moist | *1.5m depth:*<br>Moisture: 3.2% |
| 1.5 | …moist to very moist | *2.25m depth:*<br>Moisture: 3.0% |
| 2.7 | **End of Test Pit at 2.7 m depth**<br>*-sloughing below 1.9 m depth.*<br>*-test pit backfilled with excavated material.* | |

| TP15-06 | | |
|---|---|---|
| *Depth:* | | |
| 0.0 – 0.15 | **TOPSOIL** | *0.75m depth:*<br>Moisture: 8.5% |
| 0.15 – 3.0 | **GRAVEL –** medium grained, trace boulders, trace cobbles, sandy, compact, brown, moist | *1.5m depth:*<br>Moisture: 6.3% |
| 1.75 | … free water, hole filled with water from 1.75 m to 3.0 m depth | *2.25m depth:*<br>Moisture: 6.3% |
| 3.0 | **End of Test Pit at 3.0 m depth**<br>*-excessive seepage and sloughing below 1.75 m depth.*<br>*-test pit backfilled with excavated material.* | |

| TP15-07 | | |
|---|---|---|
| *Depth:*<br><br>0.0 – 3.0<br><br>3.0 | <br><br>**GRAVEL –** medium grained, trace boulders, trace cobbles, compact, brown, moist<br><br>**End of Test Pit at 2.7 m depth**<br>*-dry and open upon completion of excavation.*<br>*-test pit backfilled with excavated material.* | *0.75m depth:*<br>Moisture: 3.6%<br><br>*1.5m depth:*<br>Moisture: 5.5%<br><br>*2.25m depth:*<br>Moisture: 2.0% |

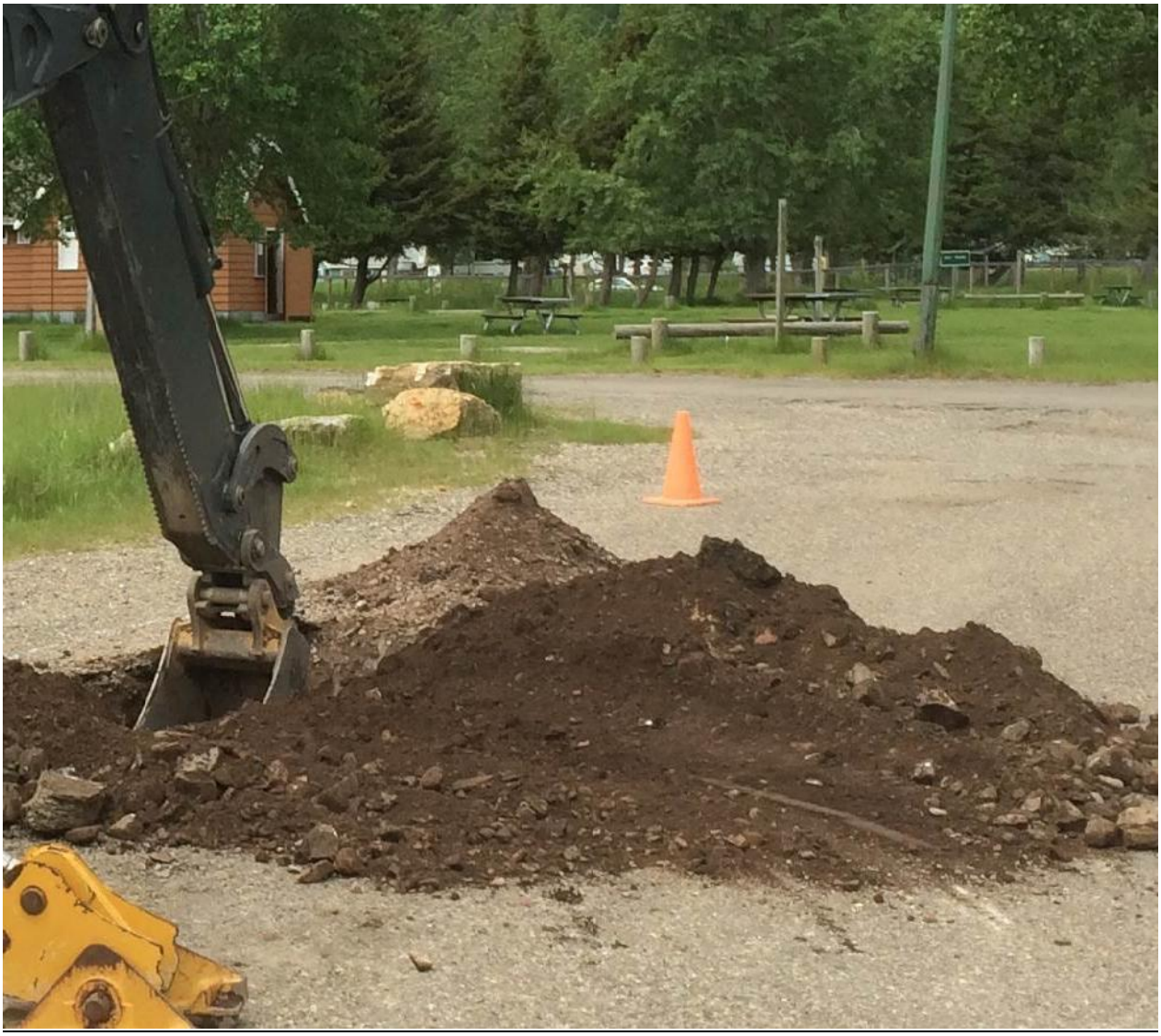
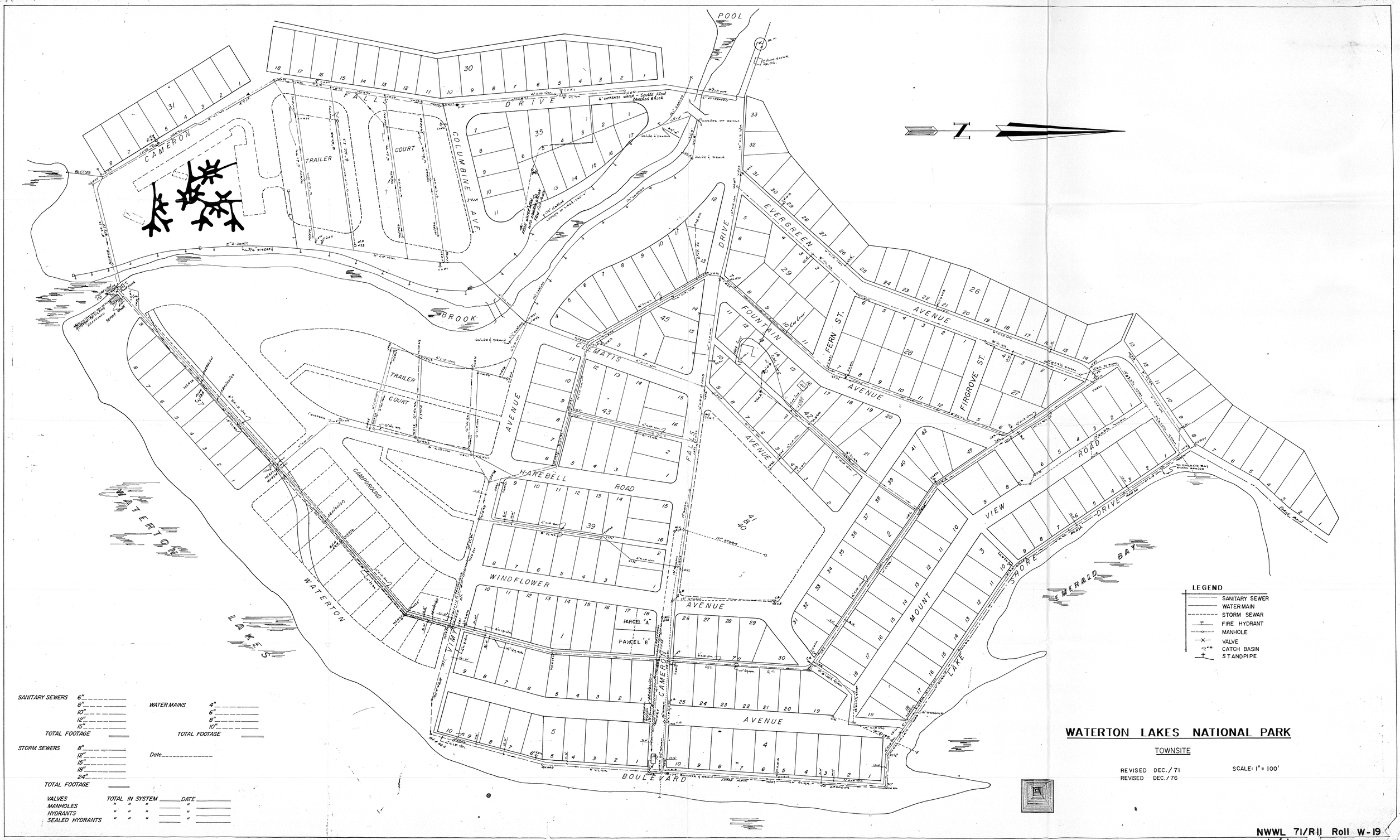


*Table Notes:*
-test pit information to be read in conjunction with Amec Foster Wheeler report LT154508.
-test pits excavated on June 10, 2015 using a John Deere 410J Loader/.
-see Figure 1 for test pit locations

# Appendix D

## Existing As-built Information

**(Electronic only)**

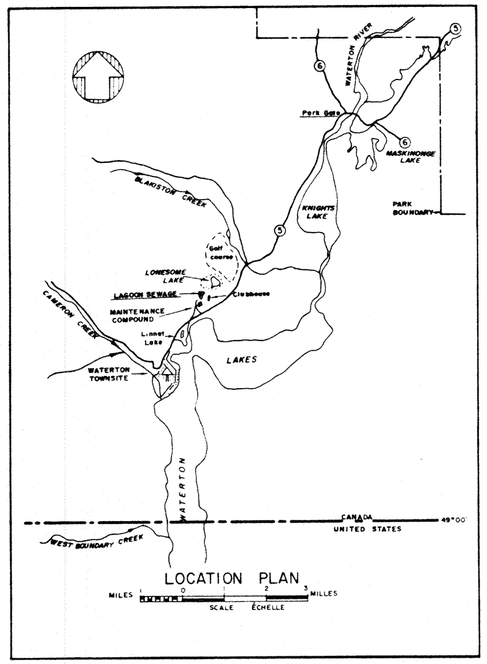



NWWL 71/R11 Roll W-19

1 of 1

# PARKS CANADA
# WESTERN REGION

## WATERTON TOWNSITE UTILITIES INVENTORY




Indian and Northern Affairs / Affaires indiennes et du Nord

revisions | date

A detail no. / détail nº
B location dwg. no. / sur dessin nº
C drawing no. / dessin nº

drawn by / tracé par: R Mirkin
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976
job captain / chef du projet | date

responsible officer / officier responsable | date

project title / titre du projet
WATERTON TOWNSITE UTILITIES INVENTORY (PHASE I)

drawing title / titre du dessin
TITLE PAGE

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 1 of 31

LAND 26-81 (6-72) 7530-21-029-1218

WL 6A, 6E

# LEGEND AND INDEX SHEET

## LEGEND:

- SANITARY MANHOLE
- STORM MANHOLE
- FIRE HYDRANT
- LIGHT POST
- VALVE
- CUTOFF INDICATOR
- CATCH BASIN
- OUTFALL

- SANITARY OR STORM LINE
- WATER LINE
- 6"STORM — SIZE AND TYPE OF LINE
- CUTOFF LINE
- 4560 — PROFILE ELEVATIONS

- (A) LINE IDENTIFICATION
- SH35 SANITARY MANHOLE IDENTIFICATION
- RH21 STORM MANHOLE IDENTIFICATION
- HE3 FIRE HYDRANT IDENTIFICATION
- G14 VALVE IDENTIFICATION

281'-0" 8" SAN SEWER AT 1.10% — LENGTH, SIZE, TYPE AND GRADE OF LINE

## INDEX:

1. TITLE PAGE
2. LEGEND AND INDEX SHEET
3. PLAN INDEX
4. KEY PLAN-WATER SYSTEM
5. KEY PLAN-SANITARY SEWER SYSTEM
6. KEY PLAN-STORM SEWER SYSTEM

### PLAN & PROFILE OF:

7. CAMERON FALLS DRIVE, FOUNTAIN AVENUE, FERN STREET
8. EVERGREEN AVENUE, FOUNTAIN AVENUE, MOUNT VIEW ROAD
9. EVERGREEN AVENUE
10. LAKE SHORE DRIVE, MOUNT VIEW ROAD
11. HAREBELL ROAD, MOUNT VIEW ROAD, FOINTAIN AVENUE, WINDFLOWER AVENUE
12. BOULEVARD, LAKE SHORE DRIVE
13. CAMERON FALLS, LANE IN BLOCK 11c
14. CLEMATIS AVENUE, WINDFLOWER AVENUE, CAMERON FALLS DRIVE
15. CAMERON FALLS DRIVE, FOUNTAIN AVENUE, WINDFLOWER AVENUE, CLEMATIS AVENUE
16. CLEMATIS AVENUE, CAMERON FALLS DRIVE
17. VIMY AVENUE, HAREBELL ROAD, CAMERON FALLS DRIVE, CLEMATIS AVENUE
18. HAREBELL ROAD, CAMERON FALLS DRIVE, WINDFLOWER AVENUE
19. VIMY AVENUE, WATERTON AVENUE, CAMERON FALLS DRIVE, WINDFLOWER AVENUE
20. VIMY AVENUE, CAMERON FALLS DRIVE, BOULEVARD
21. WATERTON CAMPSITE ( BLOCK 36 )
22. HEATHER ROAD, VIMY AVENUE, HAREBELL
23. WATERTOWN AVENUE
24. CAMERON FALLS DRIVE
25. CAMERON FALLS DRIVE
26. CAMERON FALLS DRIVE
27. COLUMBINE AVENUE
28. TRAILER COURT (B SECTION), COLUMBINE AVENUE
29. TOWNSITE CAMPGROUND
30. SEWAGE TREATMENT SYSTEM
31. DEVELOPMENT PLAN
32.
33.
34.
35.
36.
37.
38.
39.

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designed by / établi par: G. Roach
checked by / vérifié par:
September, 1976
job captain / chef du projet — date
responsible officer / officier responsable — date

project title / titre du projet:
WATERTON TOWNSITE UTILITIES INVENTORY ( PHASE I )

drawing title / titre du dessin:
LEGEND AND INDEX SHEET

reference no. / nº de référence: NWWL76/R12
dwg no. / dessin nº: 2 of 31

Indian and Northern Affairs / Affaires indiennes et du Nord

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A detail no. / détail nº
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project title / titre du projet

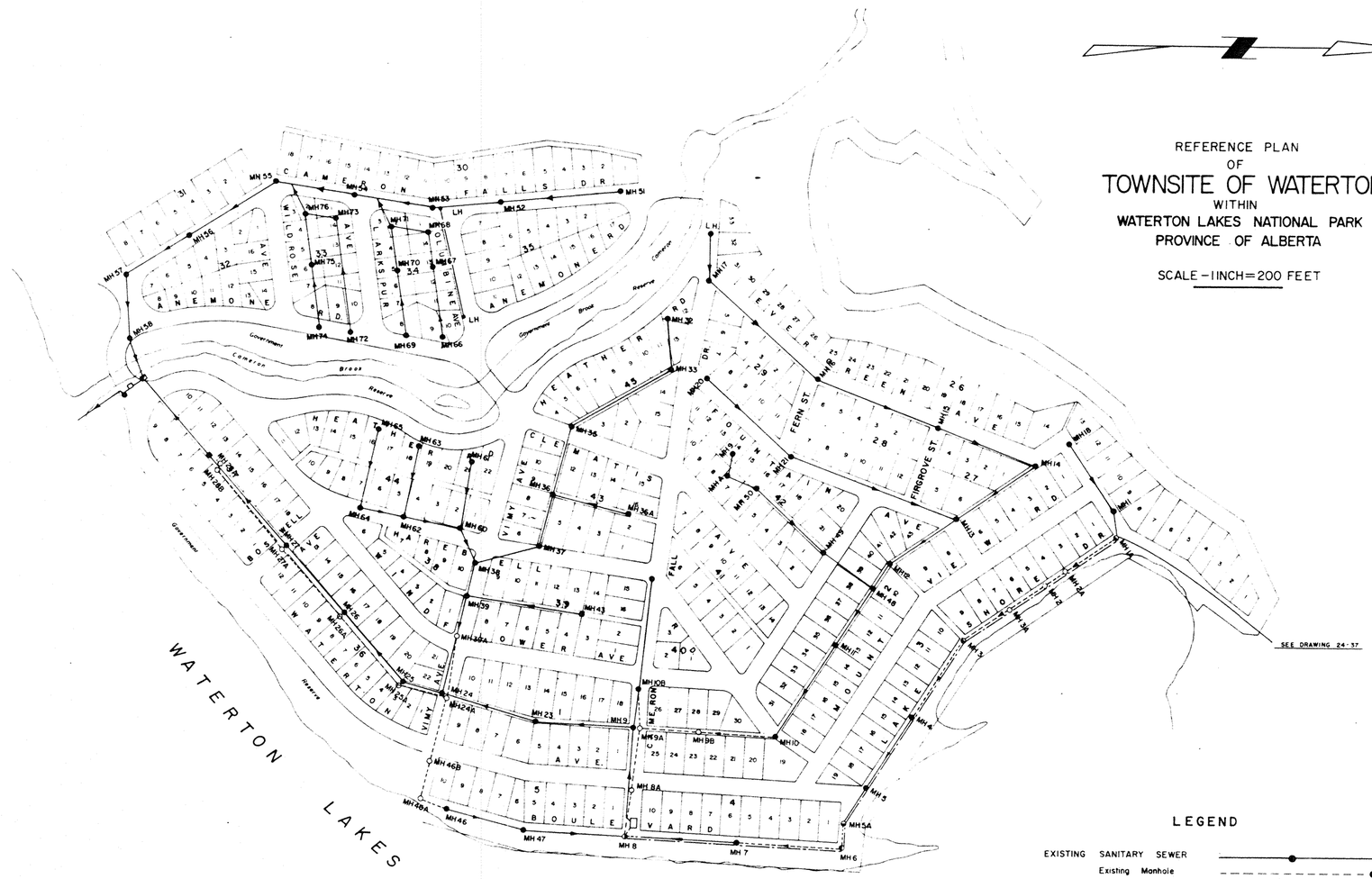
WATERTON TOWNSITE
UTILITIES INVENTORY
( PHASE I )

drawing title / titre du dessin

PLAN INDEX

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 3 of 31

IAND 56-61 (5-72) 7530-21-028-1218




REFERENCE PLAN
OF
# TOWNSITE OF WATERTON
WITHIN
WATERTON LAKES NATIONAL PARK
PROVINCE OF ALBERTA

SCALE – 1 INCH = 200 FEET

## LEGEND

| | |
|---|---|
| EXISTING SANITARY SEWER | |
| Existing Manhole | |
| Existing Manhole To Be Replaced | |
| Existing Manhole To Be Removed | |
| PROPOSED SANITARY SEWER | |
| Proposed Manhole | |
| PROPOSED FORCE MAIN | |

Indian and Northern Affairs — Affaires indiennes et du Nord

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scale / échelle: As Shown
designed by / établi par: G. Roach
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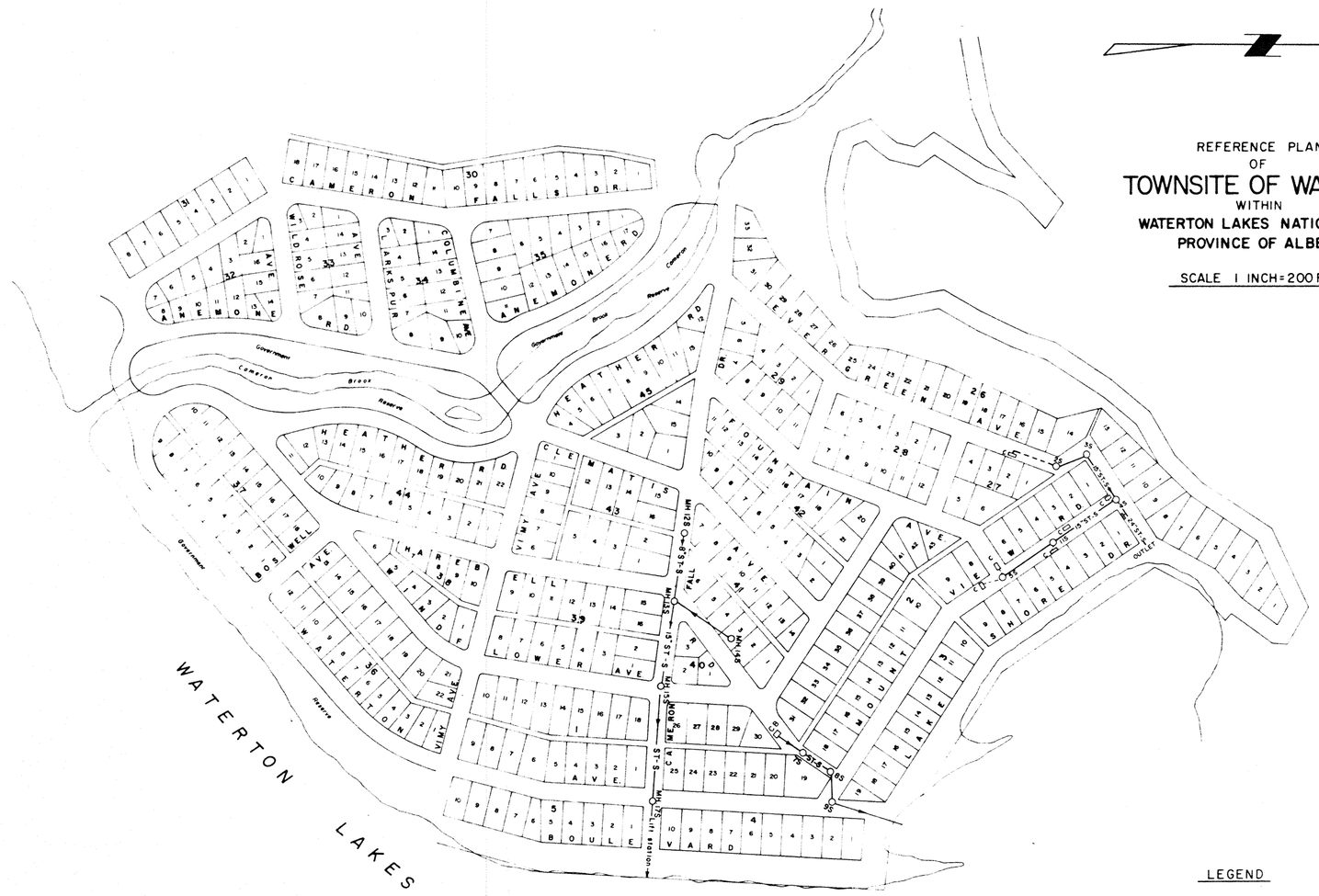
September, 1976
job captain / chef du projet — date
responsible officer / officier responsable — date

project title — titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY

drawing title — titre du dessin
KEY PLAN
SANITARY SEWER
SYSTEM

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 5 of 31

LAND 56-61 (5-72) 7530-21-609-1213




REFERENCE PLAN
OF
# TOWNSITE OF WATERTON
WITHIN
WATERTON LAKES NATIONAL PARK
PROVINCE OF ALBERTA

SCALE 1 INCH=200 FEET

LEGEND

STORM SEWER MANHOLES

CATCH BASINS

DIRECTION OF FLOW

Indian and Northern Affairs — Affaires indiennes et du Nord

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A detail no. — détail no
B location dwg. no. — sur dessin no
C drawing no. — dessin no

drawn by / tracé par: R.Mirkin
scale / échelle: as shown
designed by / établi par: G.Roach
checked by / vérifié par:

September, 1976
job captain / chef de projet — date

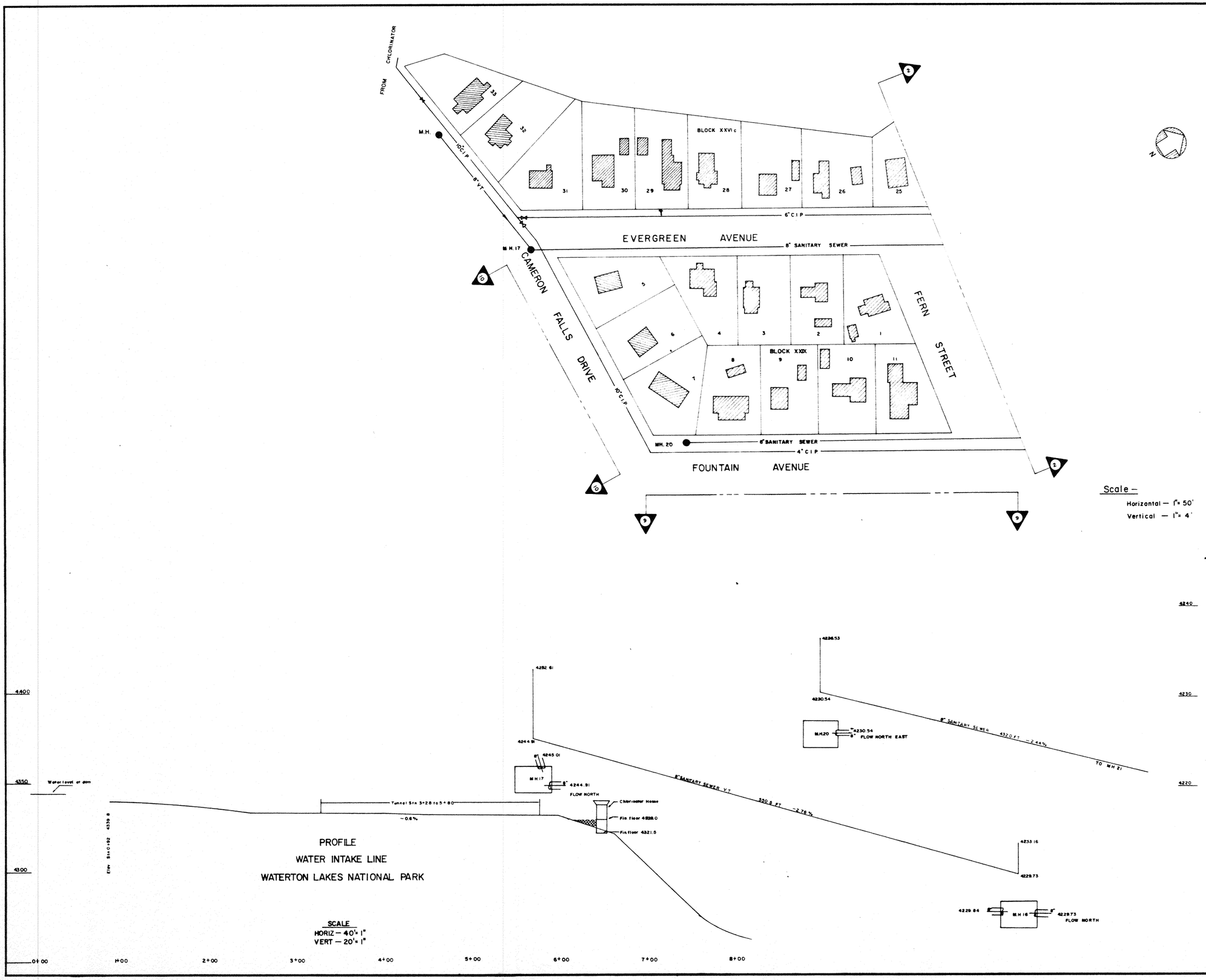
responsible officer / officier responsable — date

project title — titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title — titre du dessin
KEY PLAN
STORM SEWER

reference no. — nº de référence: NWWL 76/R12
dwg no. — dessin nº: 6 of 31

LAND 58-81 (6-72) 7530-21-029-1218

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B location dwg. no. / sur dessin nº
C drawing no. / dessin nº

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September, 1976
job captain / chef du projet | date

responsible officer / officier responsable | date

project title / titre du projet
WATERTON TOWNSITE UTILITIES INVENTORY (PHASE I)

drawing title / titre du dessin
PLAN & PROFILE –
CAMERON FALLS DR., FOUNTAIN AVENUE, FERN STREET

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 7 of 31

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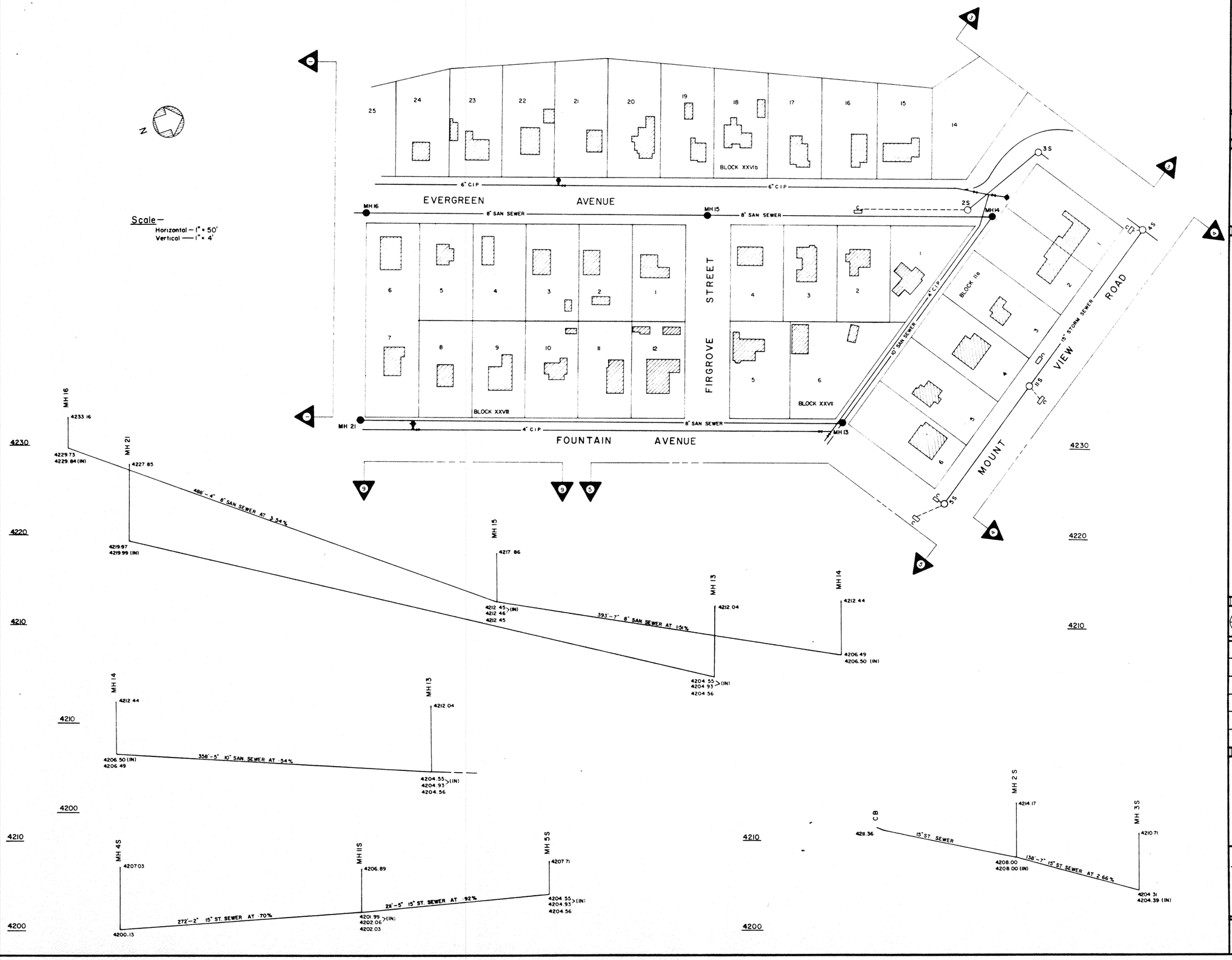


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C drawing no. / dessin n°

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September, 1976

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responsible officer / officier responsable | date

project title / titre du projet

WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

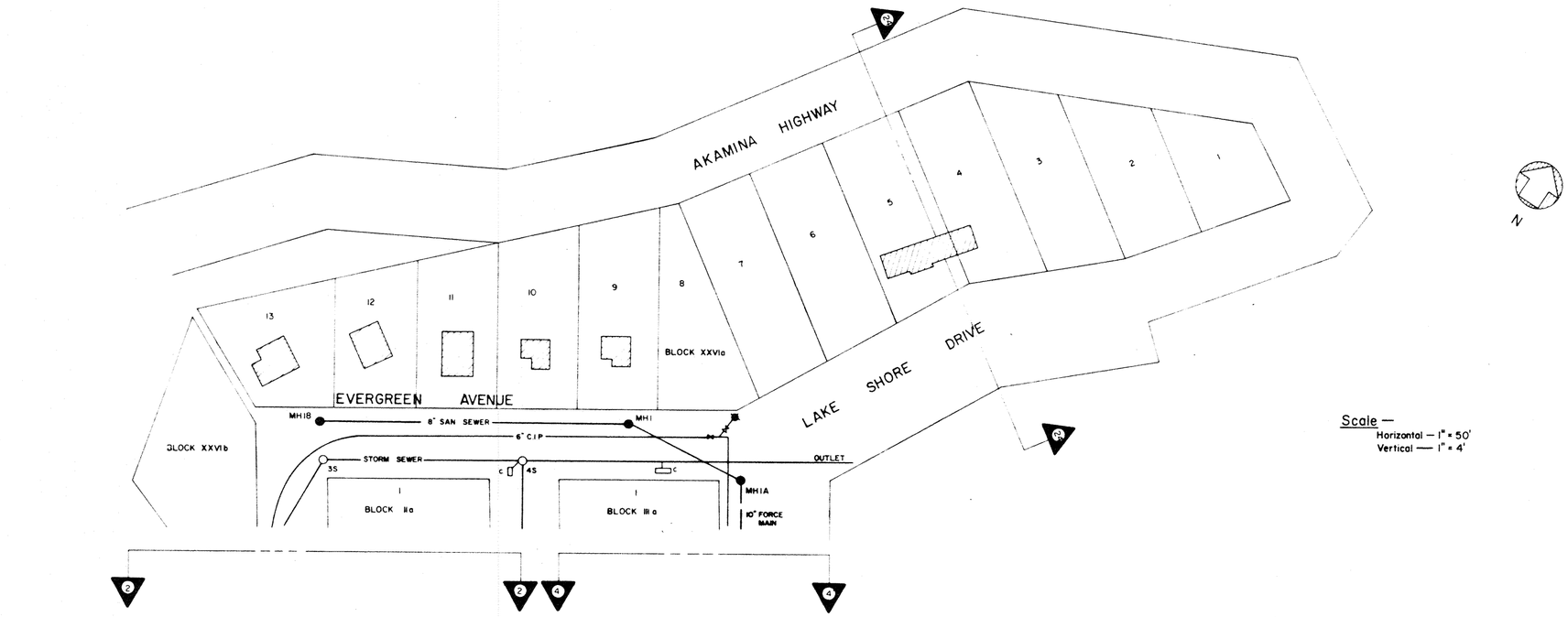
drawing title / titre du dessin

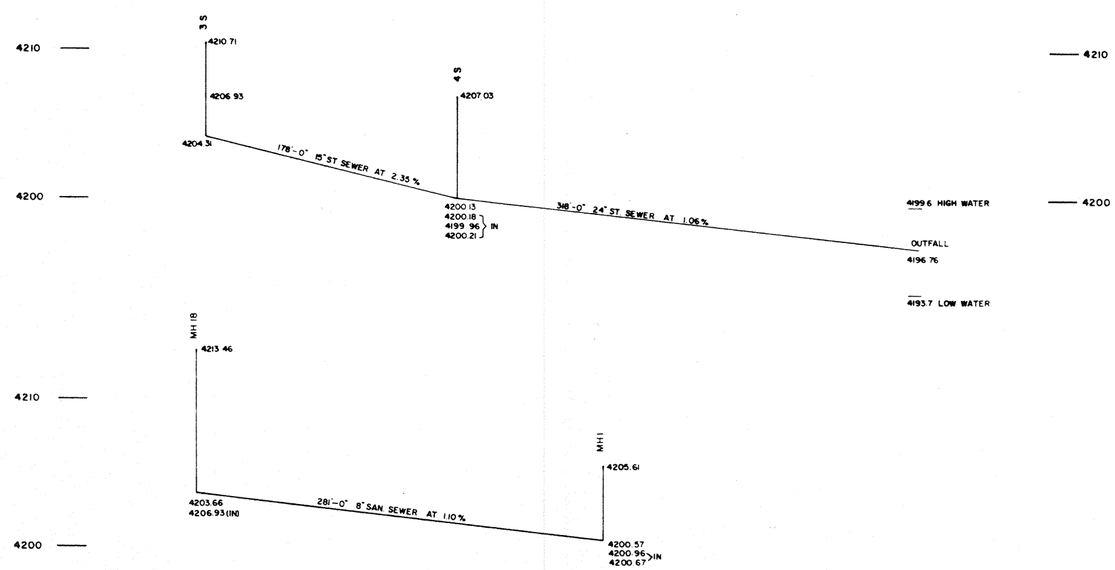
PLAN & PROFILE —
EVERGREEN AVE., FOUNTAIN AVE., MOUNT VIEW ROAD

reference no. / n° de référence: NWWL 76/R12

dwg no. / dessin n°: 8 of 31

IAND 86-81 (8-72) 7530-21-609-1218




Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

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B location dwg. no. — sur dessin no
C drawing no. — dessin no

drawn by / tracé par: M.S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976

job captain / chef du projet — date

responsible officer / officier responsable — date

project title — titre du projet

WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

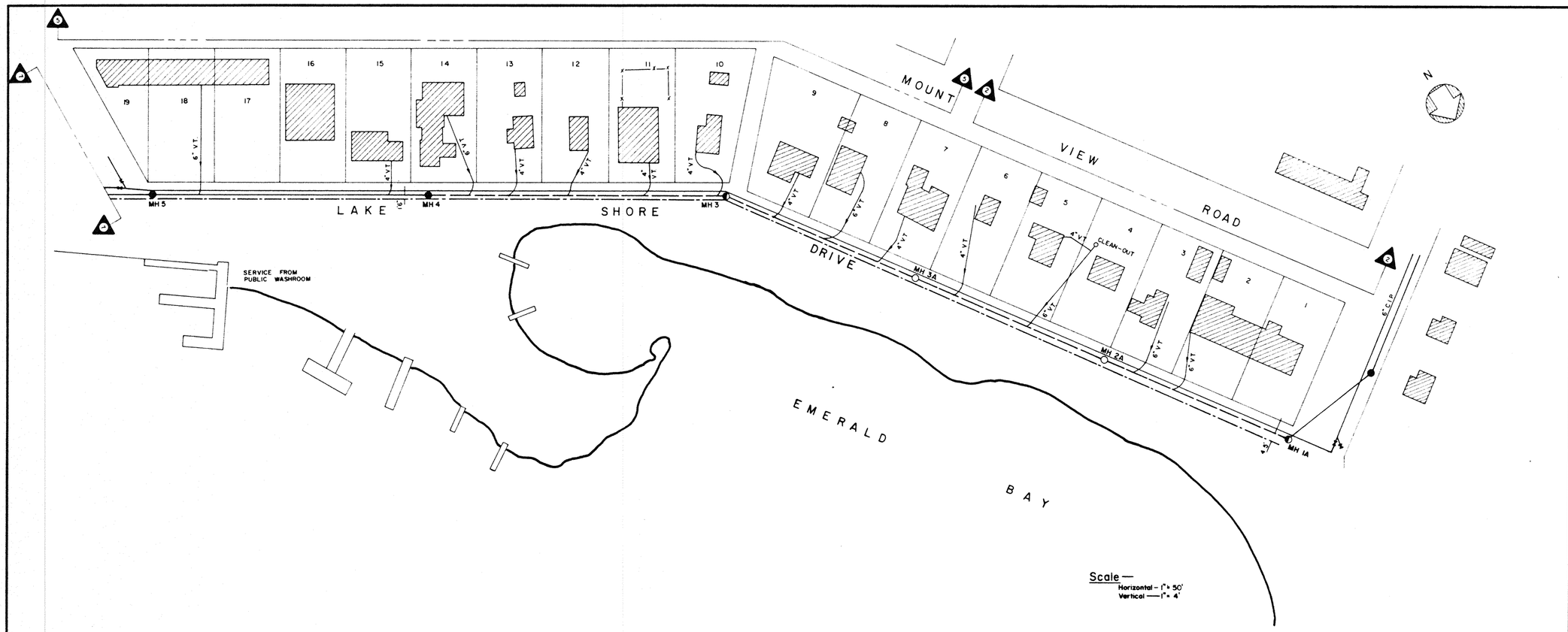
drawing title — titre du dessin

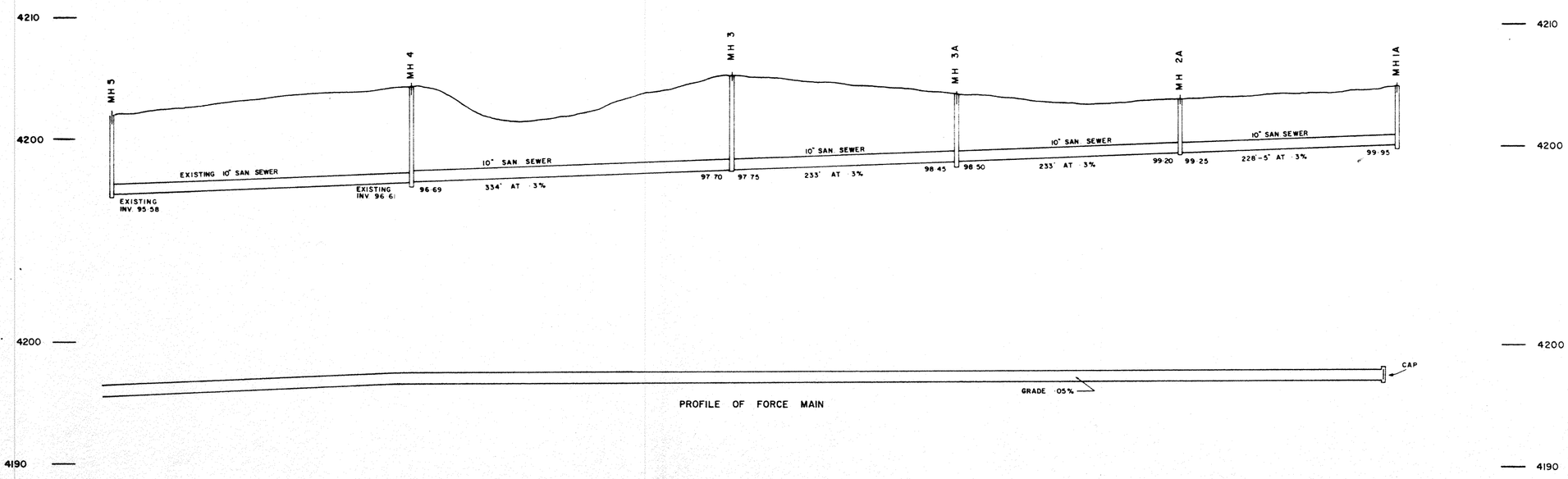
PLAN & PROFILE —
EVERGREEN AVENUE

reference no. — no de référence: NWWL 76/R12

dwg no. — dessin no: 9 of 31

IAND 88-91 (6-72) 7539-21-000-1210




PROFILE OF FORCE MAIN

Indian and Northern Affairs / Affaires indiennes et du Nord

revisions | date

A detail no. / détail nº
B location dwg. no. / sur dessin nº
C drawing no. / dessin nº

drawn by / tracé par: M.S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

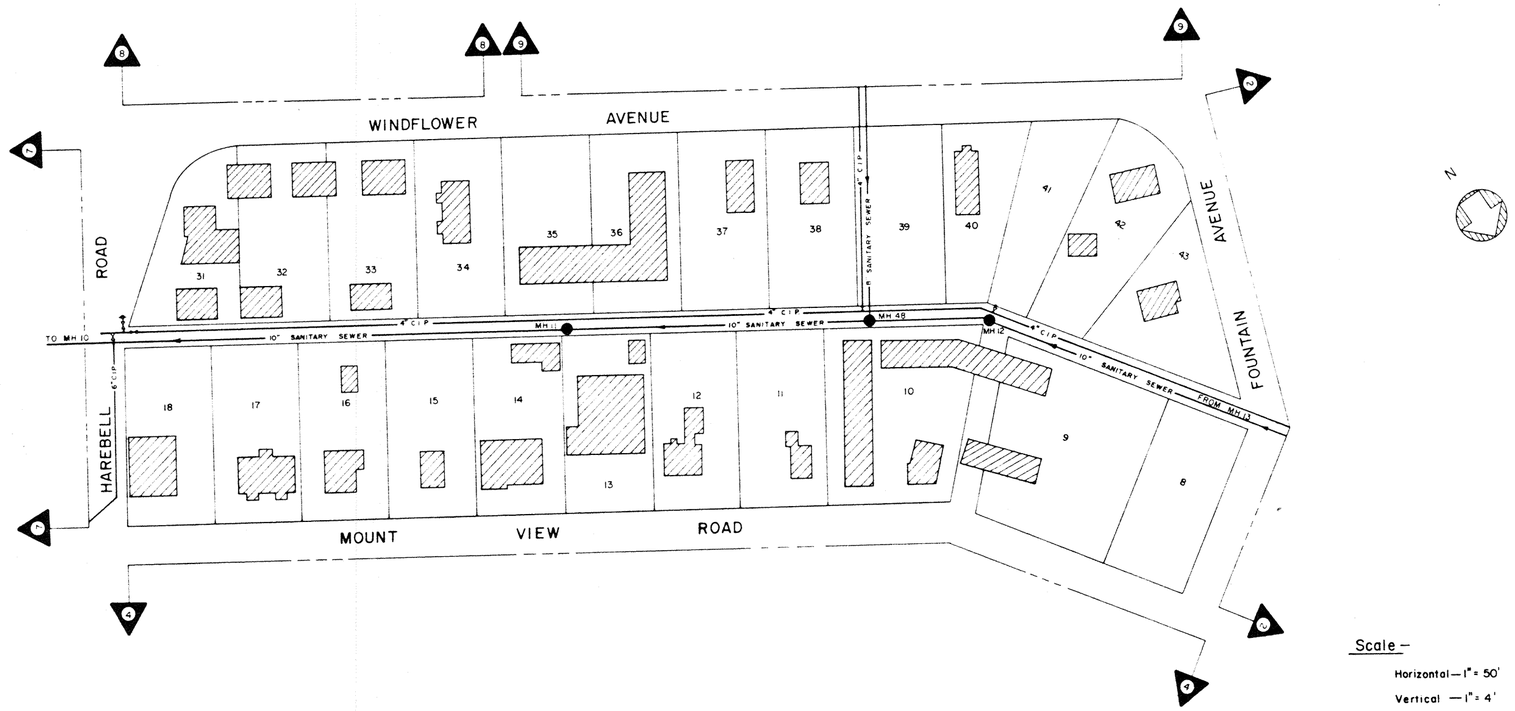
September, 1976
job captain / chef du projet | date
responsible officer / officier responsable | date

project title / titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin
PLAN & PROFILE —
LAKE SHORE DRIVE
MOUNT VIEW ROAD

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 10 of 31

IAND 86-81 (8-72) 7530-21-029-1216

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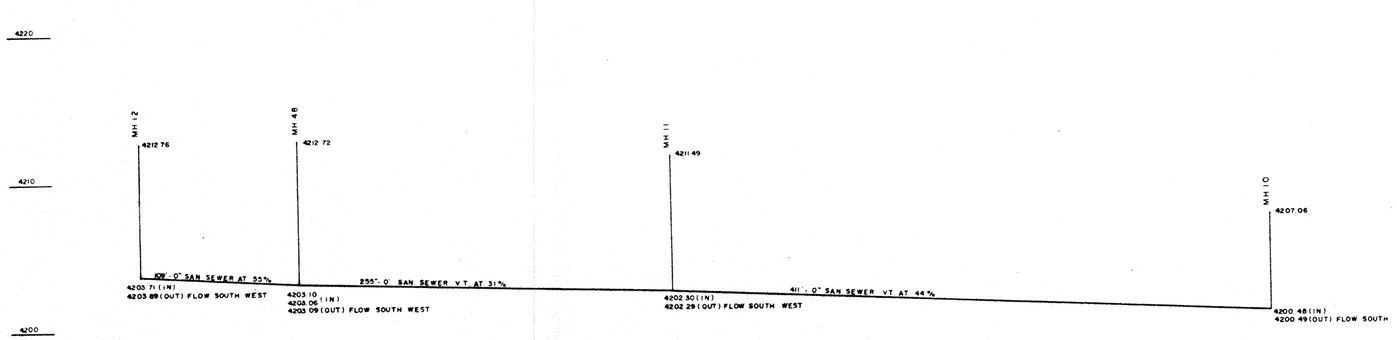
Vertical — 1" = 4'




Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail no
B location dwg. no. — sur dessin no
C drawing no. — dessin no

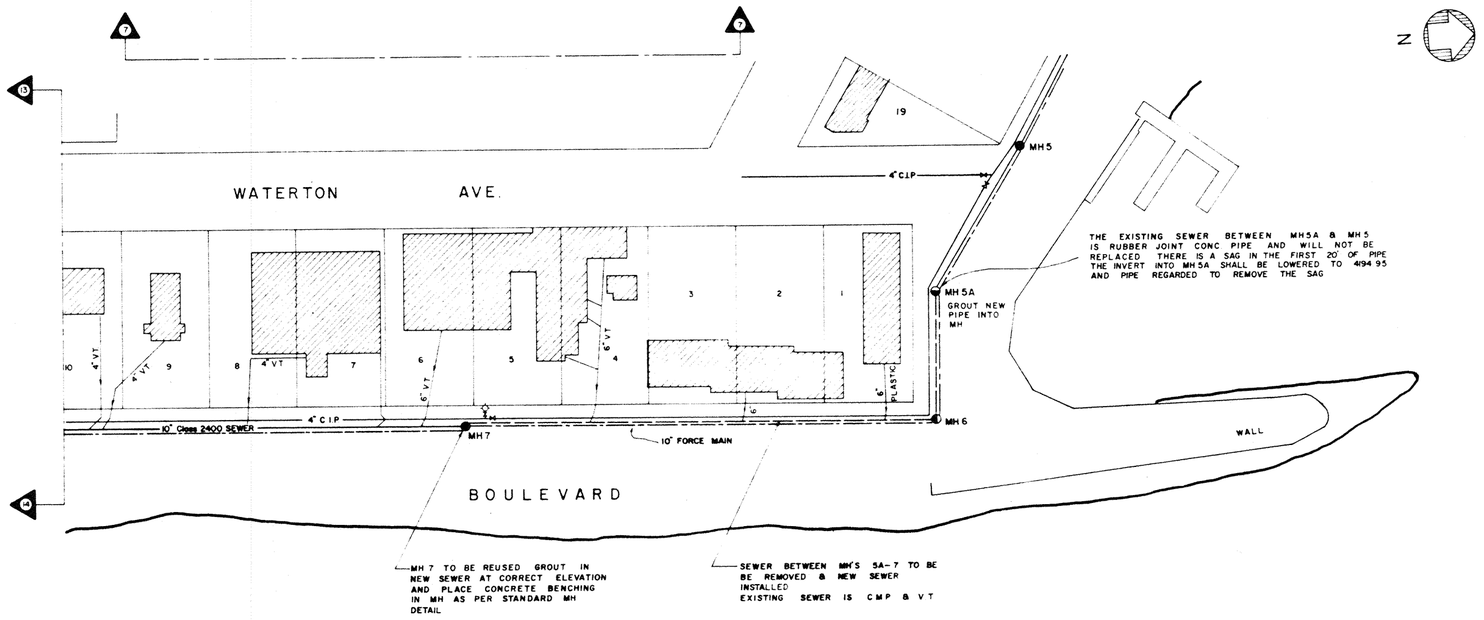
drawn by / tracé par: R M
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:
September, 1976
job captain / chef du projet — date
responsible officer / officier responsable — date

project title — titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title — titre du dessin
PLAN & PROFILE –
HAREBELL ROAD, MOUNT VIEW ROAD, FOUNTAIN AVE., WINDFLOWER AVENUE

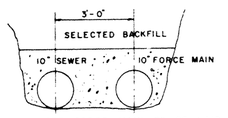
reference no. — no de référence: NWWL 76/R12
dwg no. — dessin no: 11 of 31

LAND 56-61 (9-72) 7530-21-029-1216

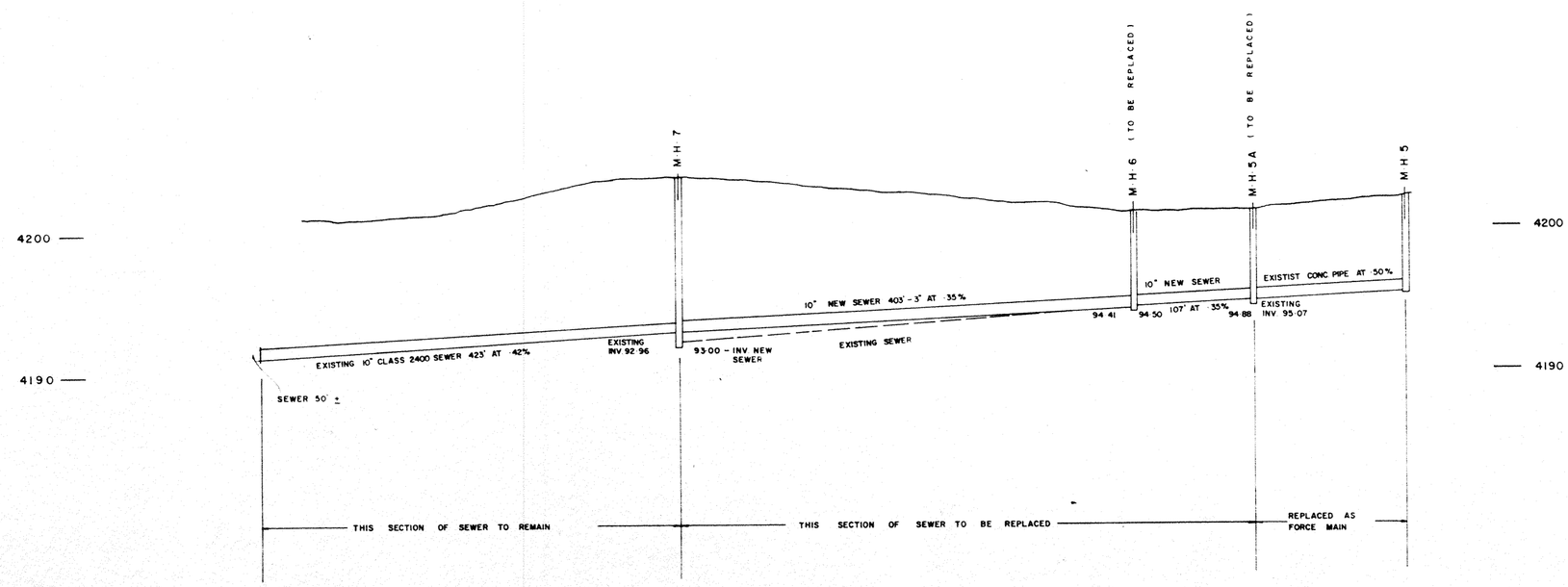



WATERTON LAKES

Scale—
HORIZONTAL — 1" = 50'
VERTICAL — 1" = 4'




NOTE FORCE MAIN TO BE LAID AT THE SAME ELEVATION AS EXISTING PIPE EXCEPT WHERE OTHERWISE NOTED.




Indian and Northern Affairs — Affaires indiennes et du Nord

revisions | date

A detail no. — détail no
B location dwg. no. — emr dessin no
C drawing no. — dessin no

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scale / échelle: as shown
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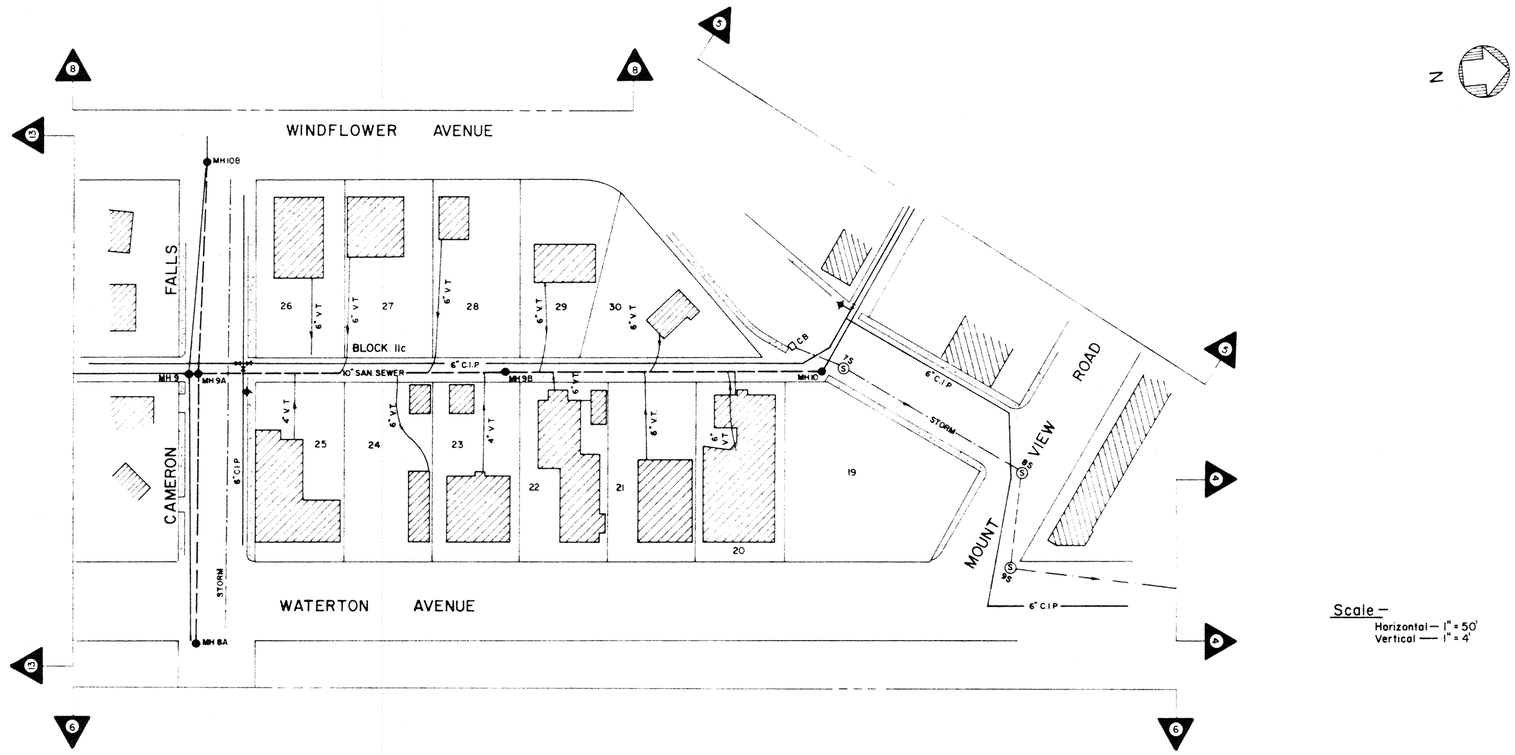
checked by / vérifié par:
September, 1976
job captain / chef du projet — date
responsible officer / officier responsable — date

project title / titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY

drawing title / titre du dessin
PLAN & PROFILE—
BOULEVARD, LAKE SHORE DR.

reference no. / no de référence: NWWL 76/R 12
dwg no. / dessin no: 12 of 31

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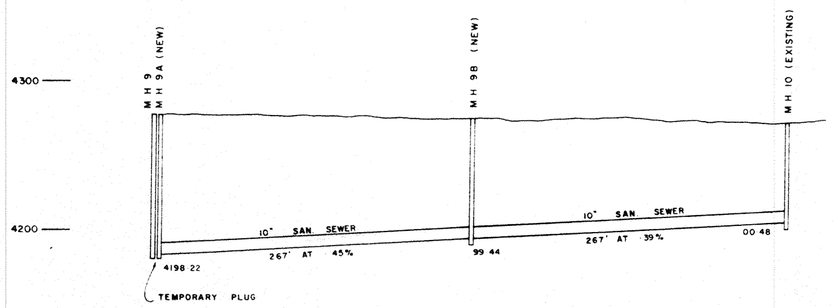


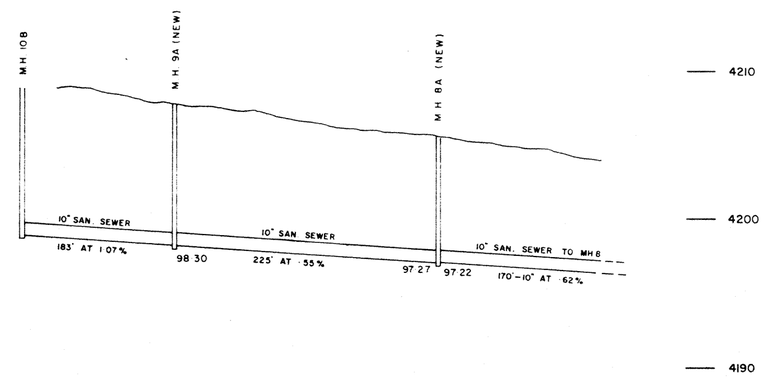


Indian and Northern Affairs / Affaires indiennes et du Nord

revisions | date

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scale / échelle: as shown
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checked by / vérifié par:

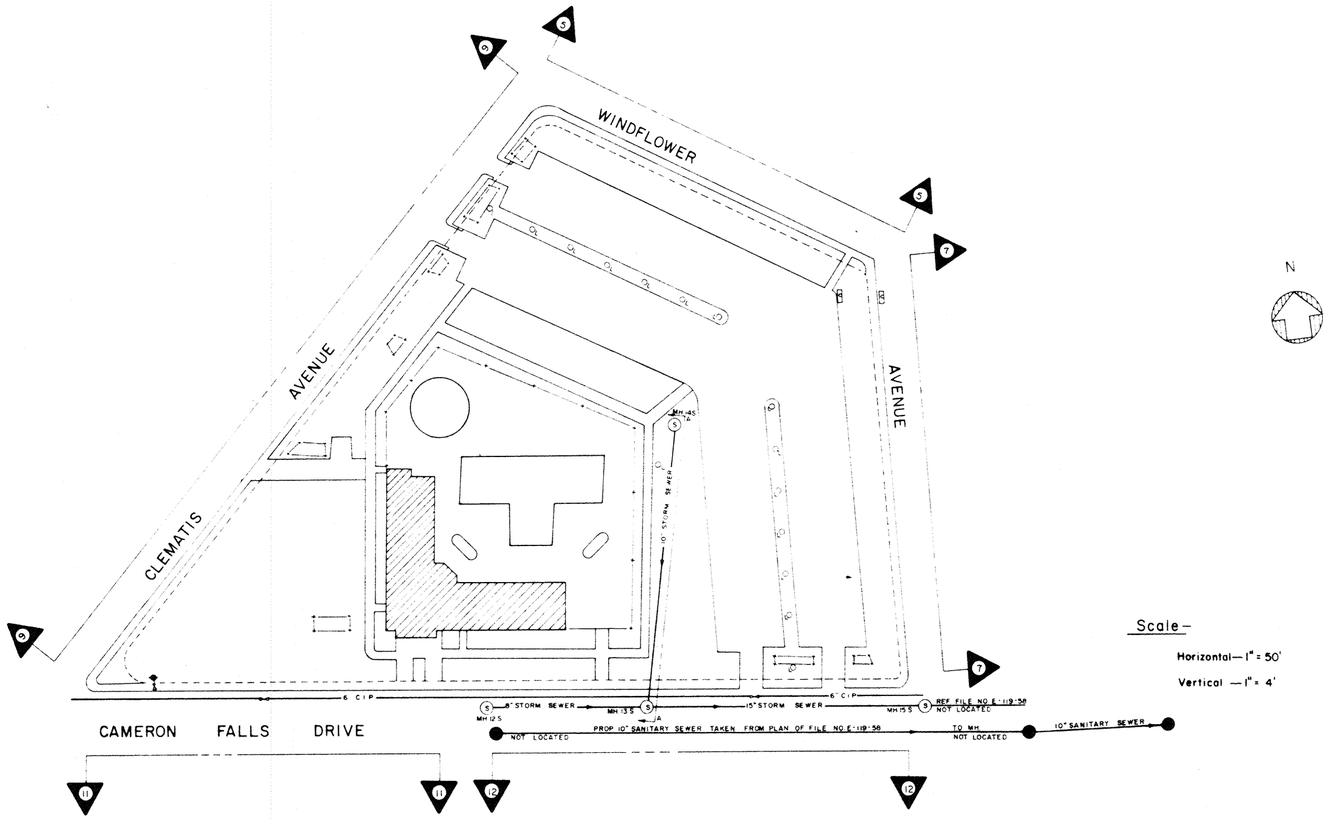
September, 1976
job captain / chef du projet | date
responsible officer / officier responsable | date

project title / titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin
PLAN & PROFILE
CAMERON FALLS, LANE IN BLOCK IIc

reference no. / no de référence: NWWL 76/R12
dwg no. / dessin no: 13 of 31

IAND 86-81 (5-72) 7530-21-026-1218

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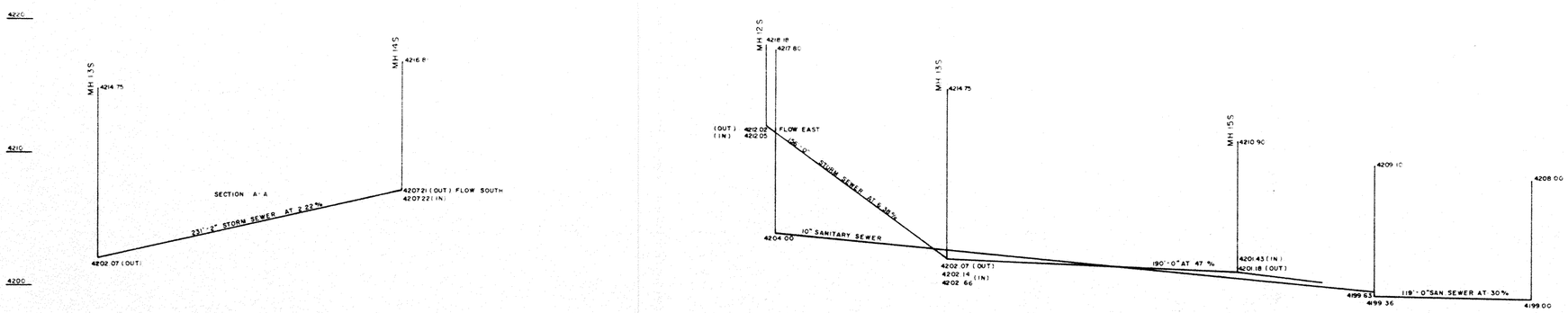
Vertical — 1" = 4'




Indian and Northern Affairs / Affaires indiennes et du Nord

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A detail no. | détail no
B location dwg. no. | sur dessin no
C drawing no. | dessin no

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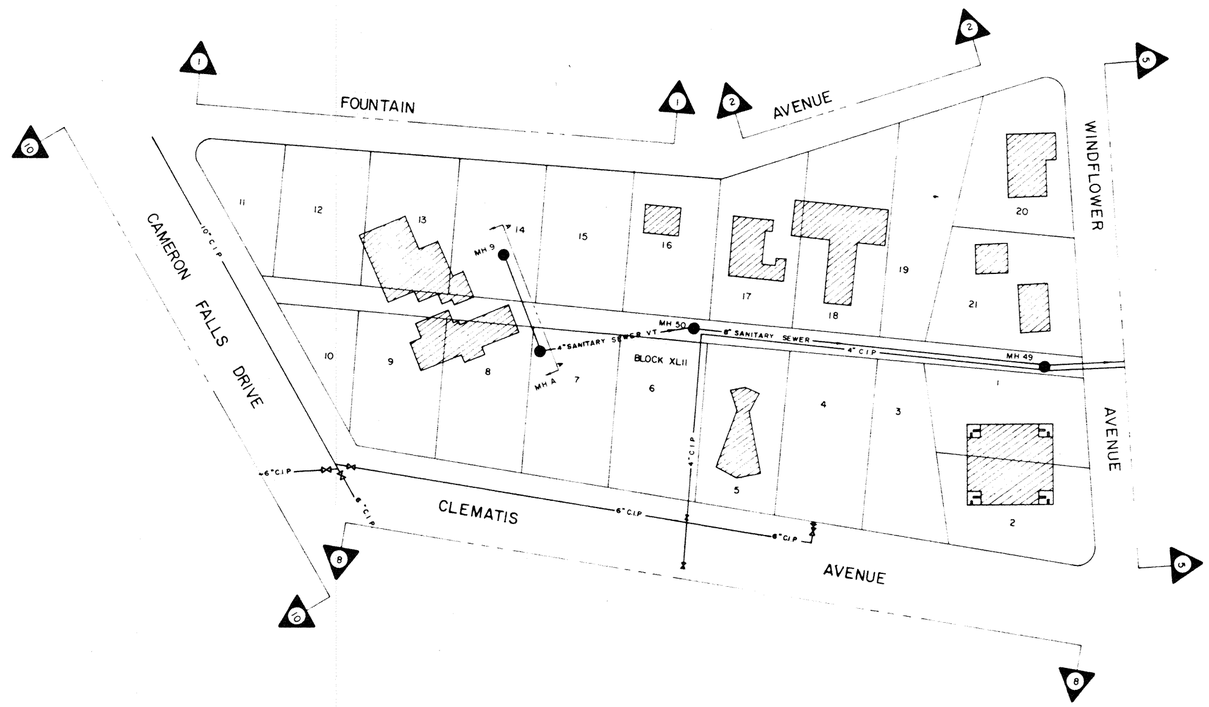
checked by / vérifié par:
September, 1976
job captain / chef du projet | date
responsible officer / officier responsable | date

project title / titre du projet:
WATERTON TOWNSITE UTILITIES INVENTORY (PHASE I)

drawing title / titre du dessin:
PLAN & PROFILE – CLEMATIS AVENUE, WINDFLOWER AVENUE, CAMERON FALLS DRIVE

reference no. / no de référence: NWWL 76/R12
dwg no. / dessin no: 14 of 31

LAND 56-81 (5-72) 7530-21-028-1716

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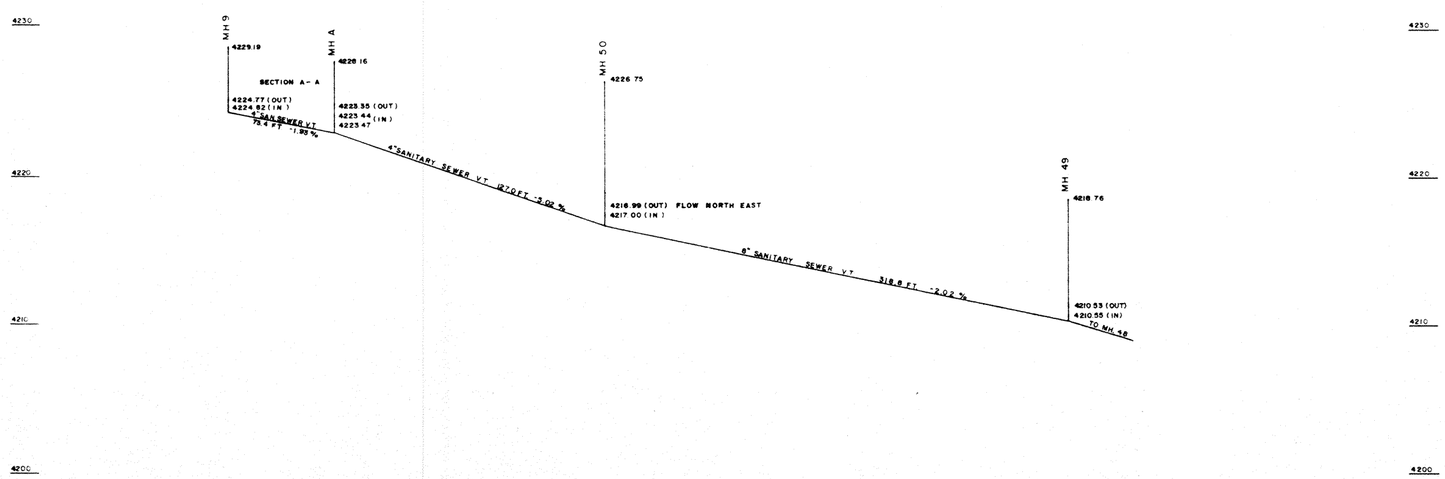



Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail nº
B location dwg. no. — sur dessin nº
C drawing no. — dessin nº

drawn by / tracé par: RM
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976

job captain / chef du projet — date

responsible officer / officier responsable — date

project title / titre du projet

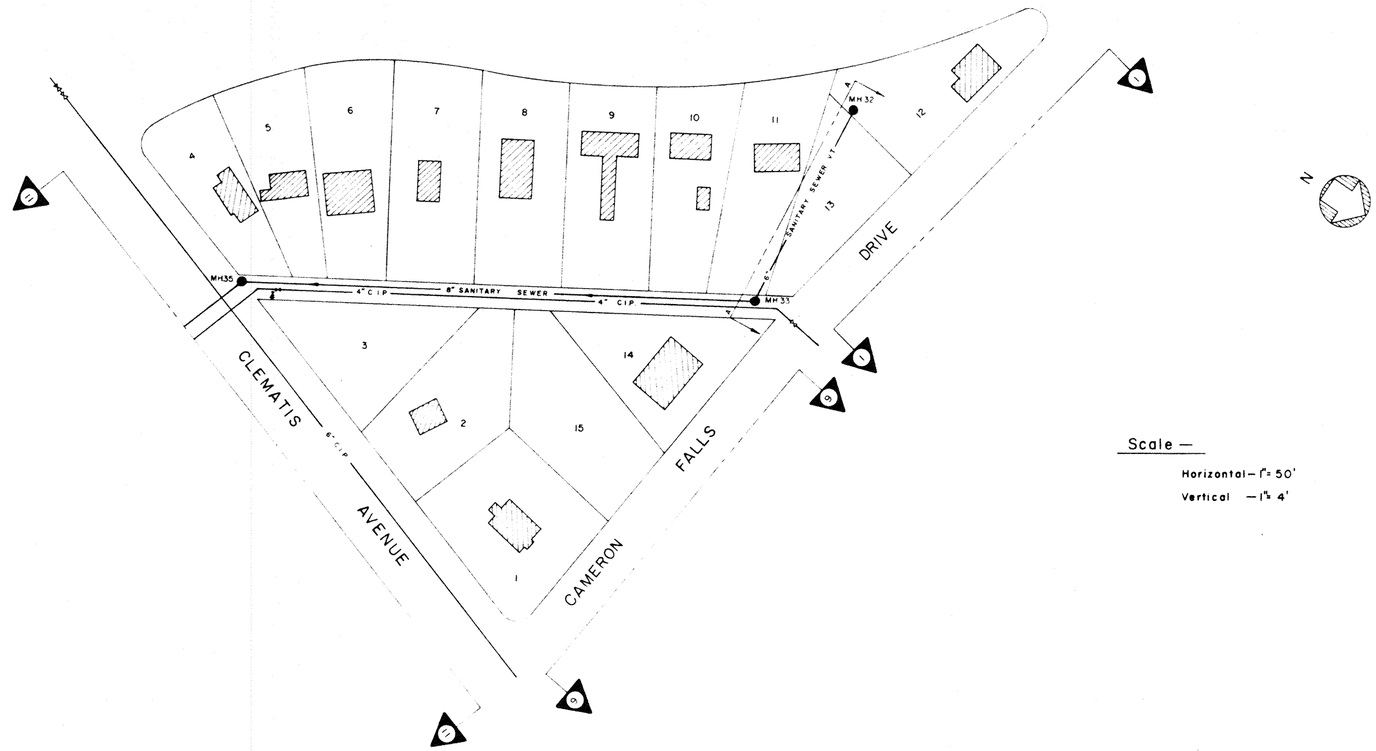
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin

PLAN & PROFILE –
CAMERON FALLS DRIVE,
FOUNTAIN AVENUE,
WINDFLOWER AVENUE,
CLEMATIS AVENUE

reference no. / nº de référence: NWWL 76/R12

dwg no. / dessin nº: 15 of 31

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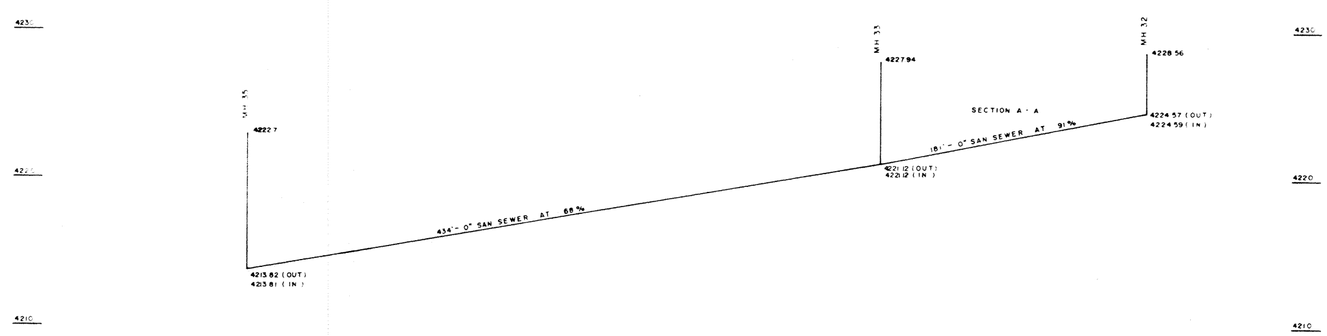
Vertical — 1" = 4'




Indian and Northern Affairs / Affaires indiennes et du Nord

revisions | date

A detail no. / détail nº
B location dwg. no. / sur dessin nº
C drawing no. / dessin nº

drawn by / tracé par: R.M.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976

job captain / chef du projet — date

responsible officer / officier responsable — date

project title / titre du projet

WATERTON TOWNSITE
UTILITIES INVENTORY
( PHASE I )

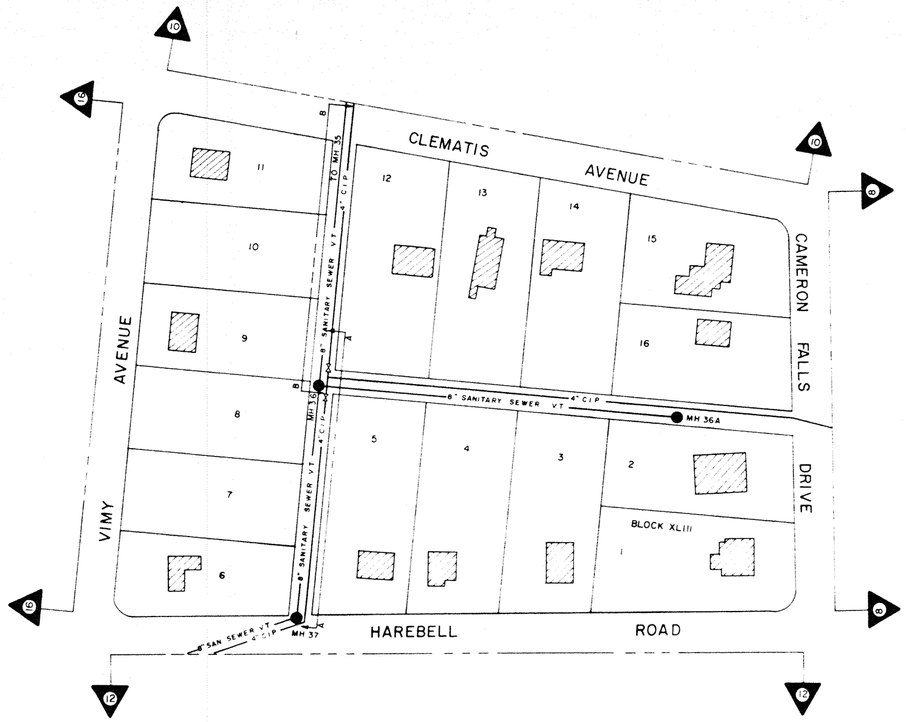
drawing title / titre du dessin

PLAN & PROFILE —
CLEMATIS AVENUE,
CAMERON FALLS DRIVE

reference no. / nº de référence: NWWL 76/R12

dwg no. / dessin nº: 16 of 31

IAND 56-61 (8-72) 7530-21-029-1218

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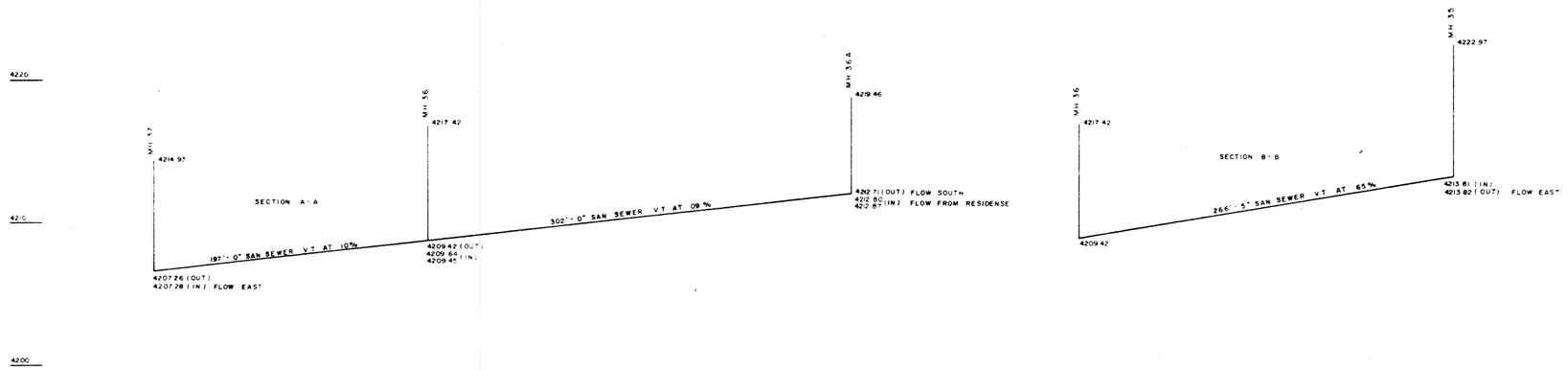



Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail nº
B location dwg. no. — sur dessin nº
C drawing no. — dessin nº

drawn by / tracé par: R.M.
scale / échelle: as shown
designed by / établi par: G Roach
checked by / vérifié par:

September, 1976
job captain / chef du projet — date

responsible officer / officier responsable — date

project title — titre du projet

WATERTON TOWNSITE

UTILITIES INVENTORY

( PHASE I )

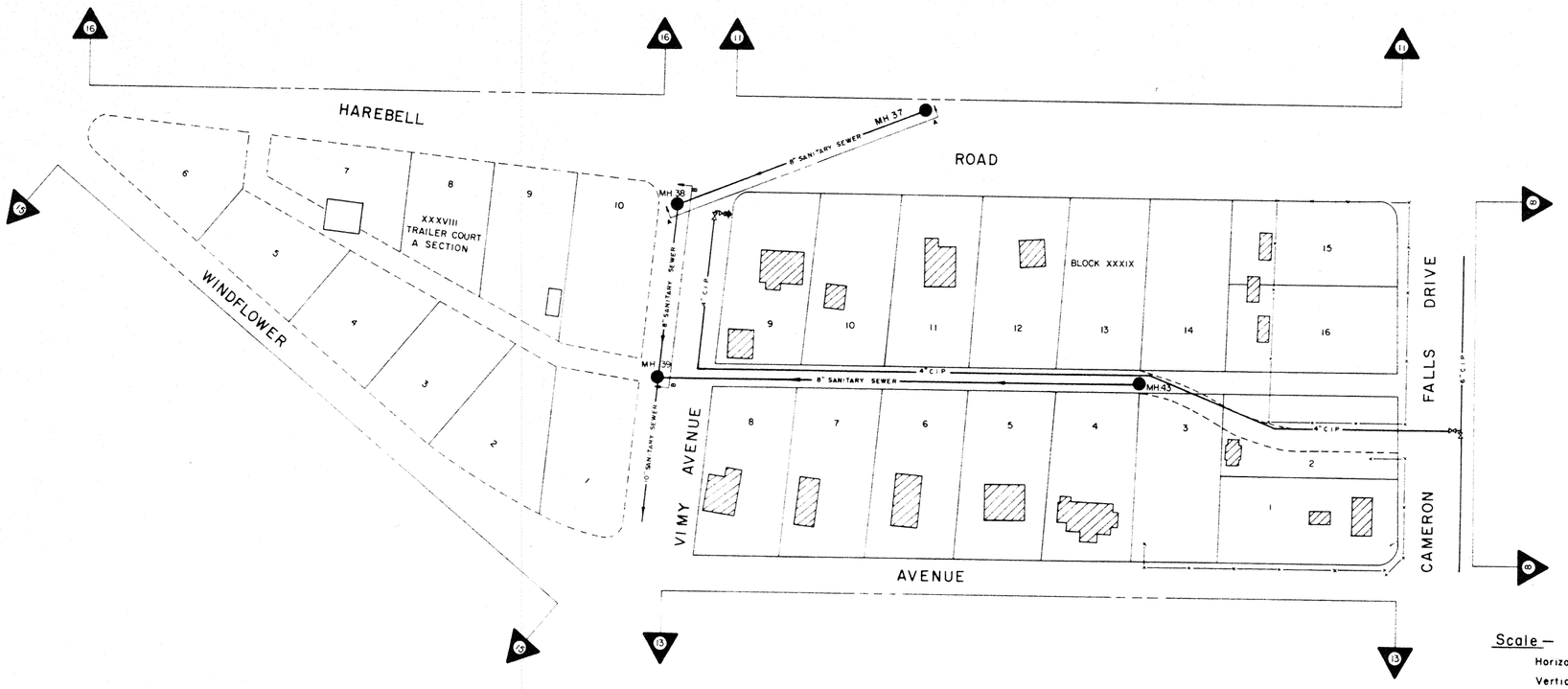
drawing title — titre du dessin

PLAN & PROFILE —
VIMY AVE., HAREBELL ROAD,
CAMERON FALLS DRIVE,
CLEMATIS AVENUE

reference no. / nº de référence: NWWL 76/R12

dwg no. / dessin nº: 17 of 31

IAND 55-81 (5-72) 7530-21-028-1218

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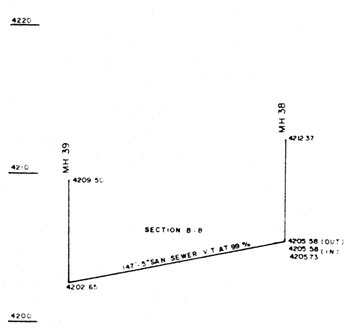
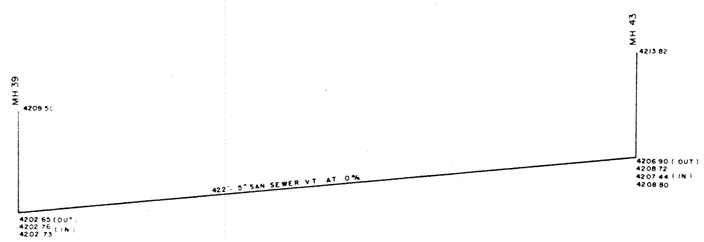
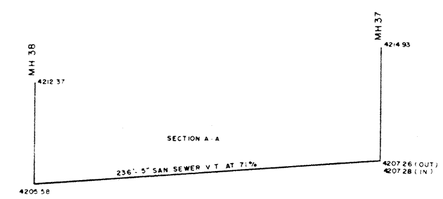



Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail no
B location dwg. no. — sur dessin no
C drawing no. — dessin no

drawn by / tracé par: R.M
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976

job captain / chef du projet — date
responsible officer / officier responsable — date

project title — titre du projet

WATERTON TOWNSITE UTILITIES INVENTORY (PHASE I)

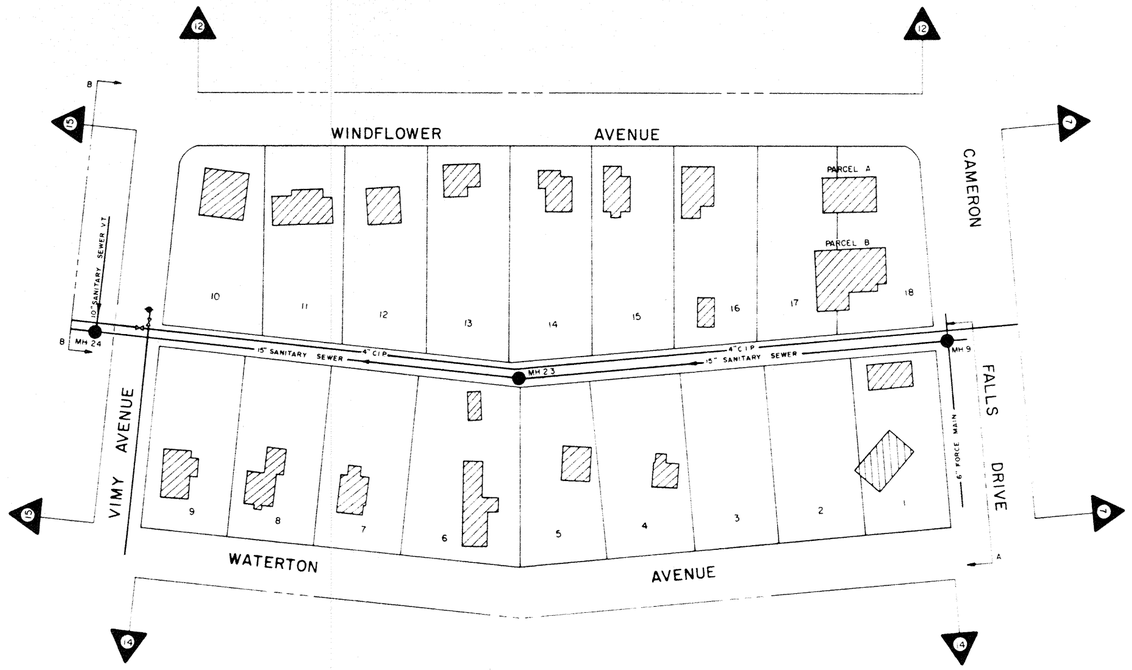
drawing title — titre du dessin

PLAN & PROFILE —
HAREBELL ROAD, CAMERON FALLS DRIVE, WINDFLOWER AVENUE

reference no. — nº de référence: NWWL 76/R12

dwg no. — dessin nº: 18 of 31

LAND 56-91 (6-72) 7530-21-029-1218




Scale —

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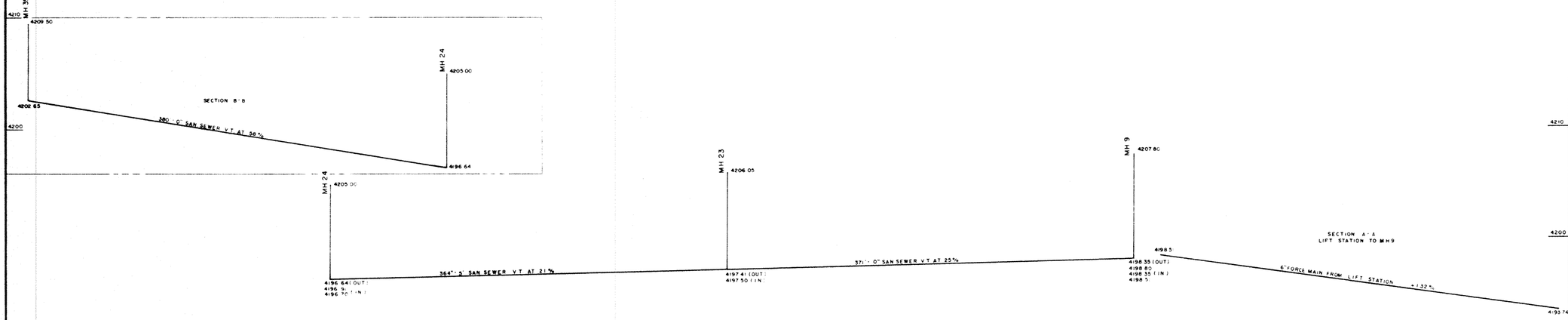
Vertical — 1" = 4'




Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail nº
B location dwg. no. — sur dessin nº
C drawing no. — dessin nº

drawn by / tracé par: R.M.
scale / échelle: as shown
designed by / établi par: G Roach
checked by / vérifié par:

September, 1976

job captain / chef du projet — date

responsible officer / officier responsable — date

project title — titre du projet

WATERTON TOWNSITE UTILITIES INVENTORY (PHASE)

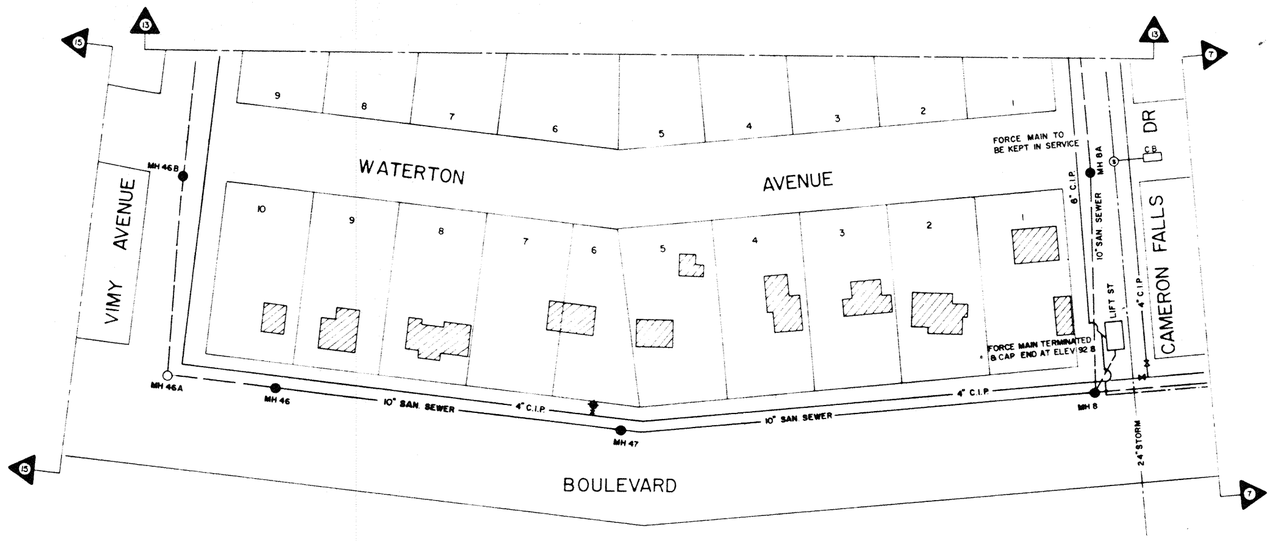
drawing title — titre du dessin

PLAN & PROFILE — VIMY AVENUE, WATERTON AVENUE, CAMERON FALLS DRIVE, WINDFLOWER AVENUE

reference no. — nº de référence: NWWL 76/R12

dwg no. — dessin nº: 19 of 31

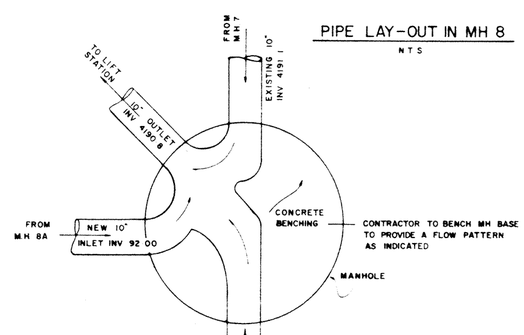
IAND 55-61 (5-72) 7530-21-029-1318

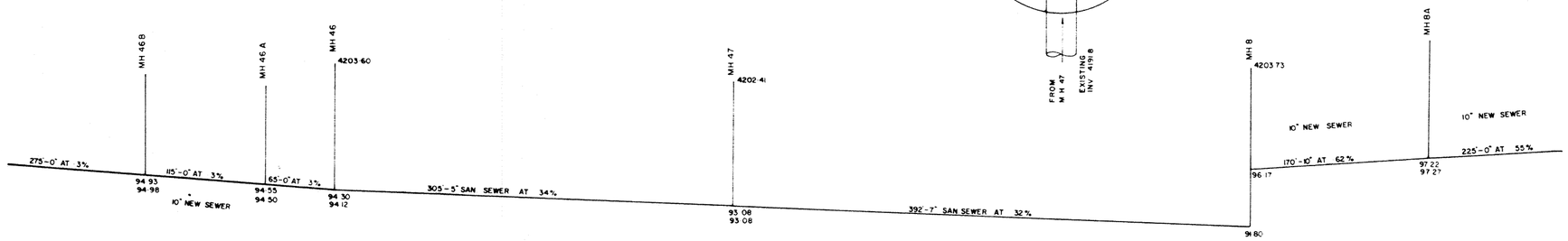



Scale—
Horizontal — 1" = 50'
Vertical — 1" = 4'

## PIPE LAY-OUT IN MH 8

N.T.S.




Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail nº
B location dwg. no. — sur dessin nº
C drawing no. — dessin nº

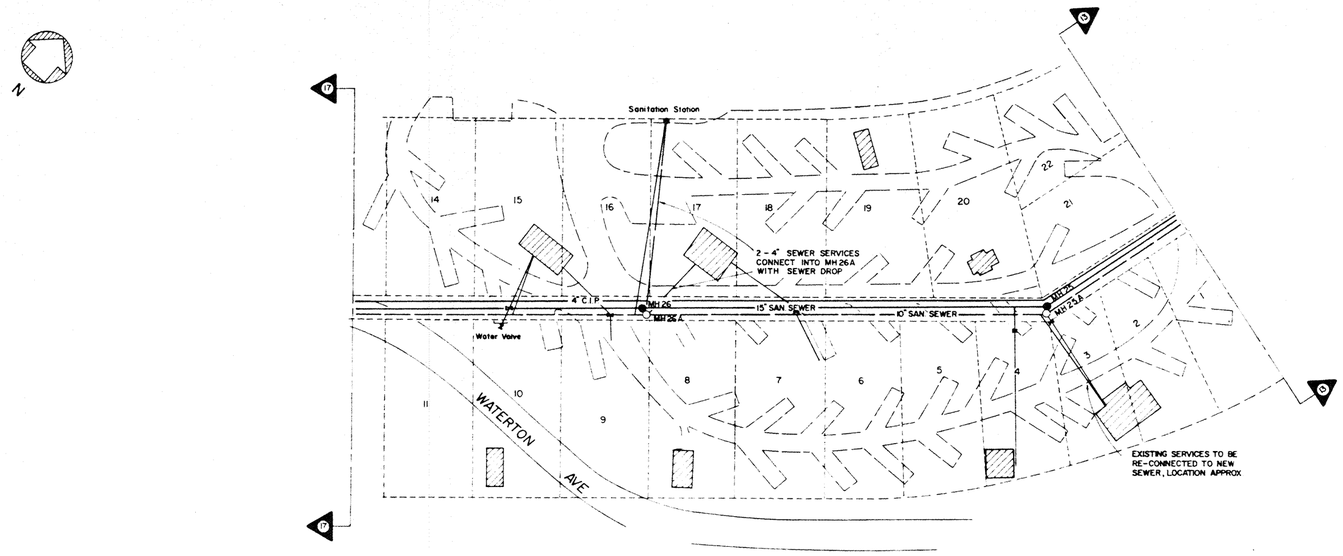
drawn by / tracé par: M.S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:
September, 1976
job captain / chef du projet — date
responsible officer / officier responsable — date

project title / titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin
PLAN & PROFILE —
VIMY AVE., CAMERON FALLS DR., BOULEVARD

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 20 of 31

MAND 98-81 (6-72) 7530-21-029-1218

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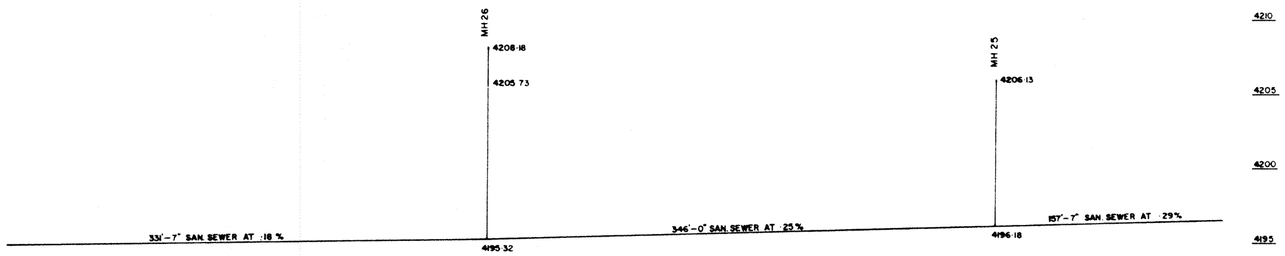
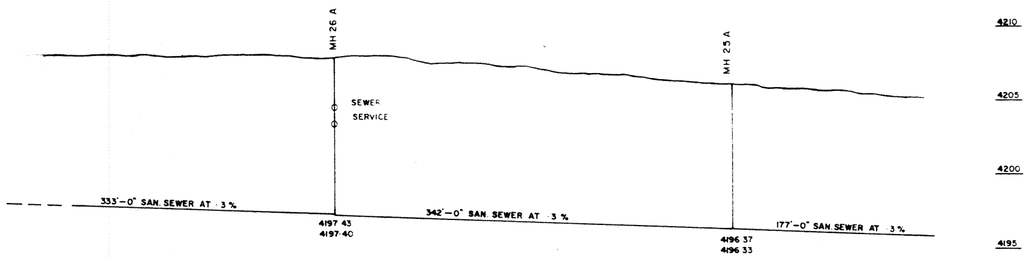
Vertical — 1" = 4'




Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail nº
B location dwg. no. — sur dessin nº
C drawing no. — dessin nº

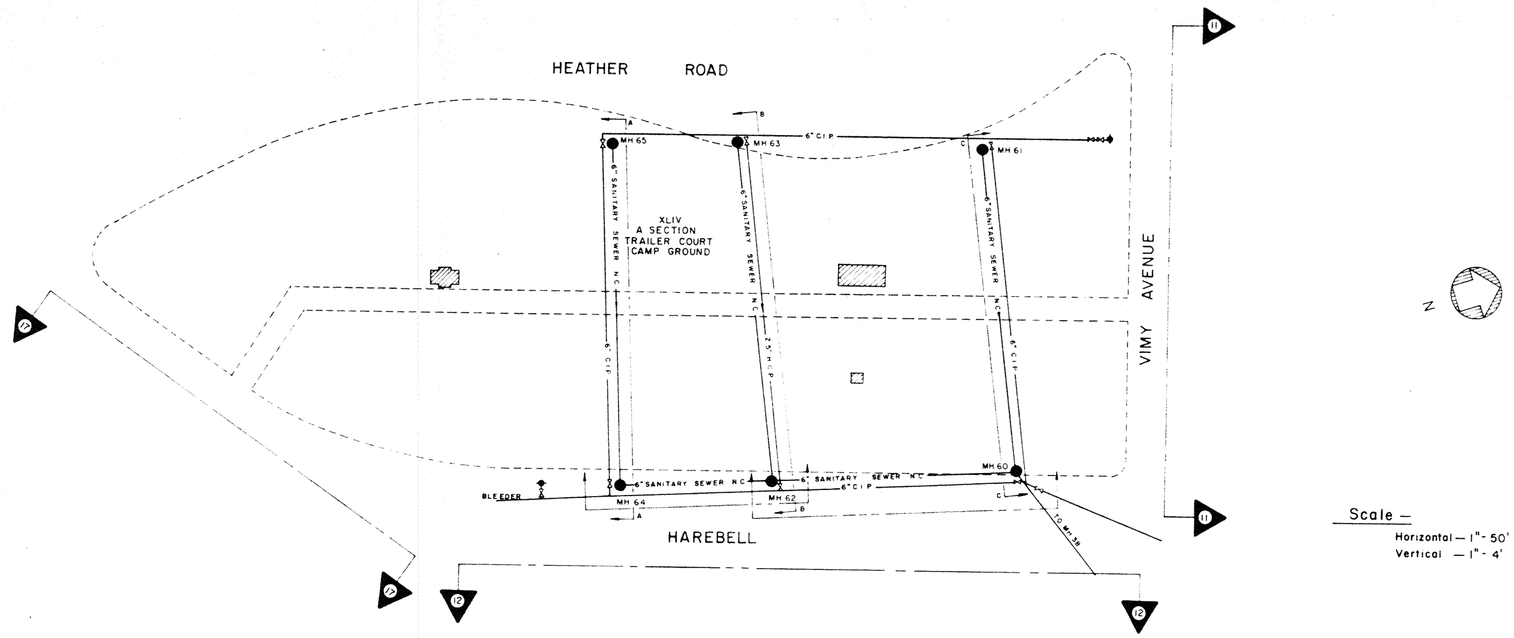
drawn by / tracé par: M.S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:
September, 1976
job captain / chef du projet — date
responsible officer / officier responsable — date

project title — titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY (PHASE I)

drawing title — titre du dessin
PLAN & PROFILE —
WATERTOWN CAMPSITE (BLOCK 36)

reference no. — nº de référence: NWWL 76/R12
dwg no. — dessin nº: 21 of 31

IAND 36-81 (5-72) 7530-21-028-1218

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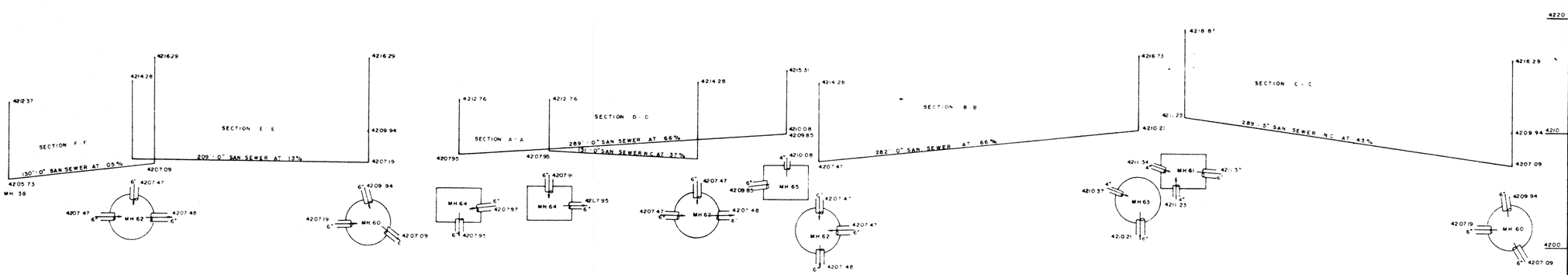



Indian and Northern Affairs / Affaires indiennes et du Nord

revisions | date

A detail no. / détail nº
B location dwg. no. / sur dessin nº
C drawing no. / dessin nº

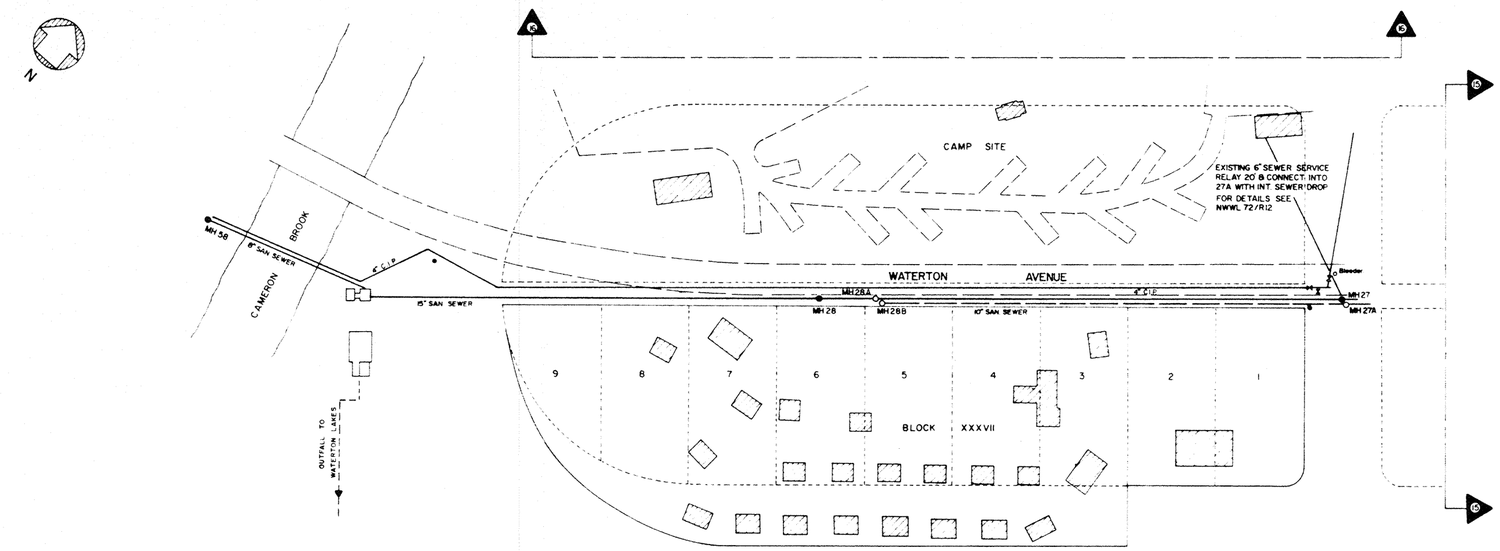
drawn by / tracé par: R.M.
scale / échelle: as shown
designed by / établi par: G. Rogers
checked by / vérifié par:
September, 1976
job captain / chef du projet | date
responsible officer / officier responsable | date

project title / titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin
PLAN & PROFILE—
HEATHER ROAD,
VIMY AVENUE,
HAREBELL

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 22 of 31

IAND 96-81 (9-72) 7530-21-029-1219

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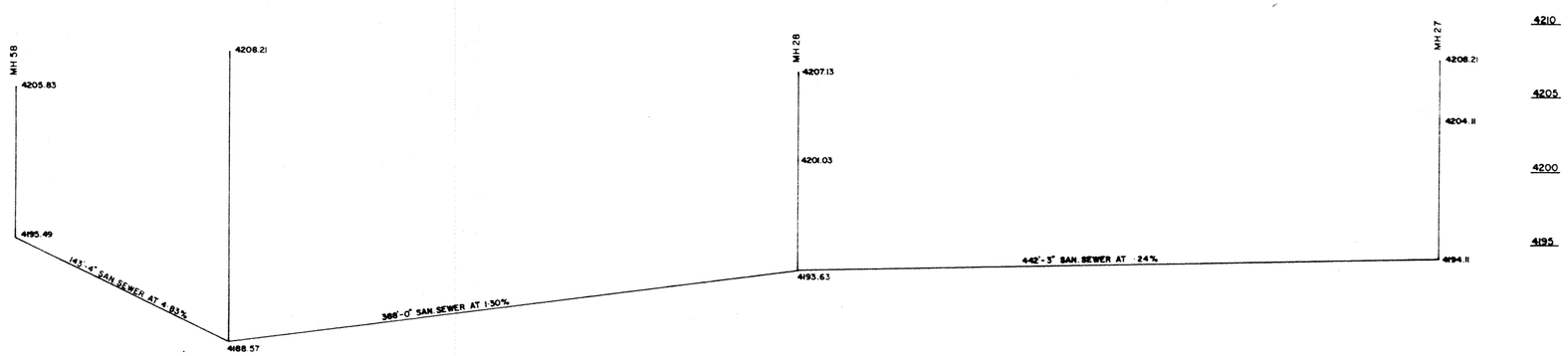
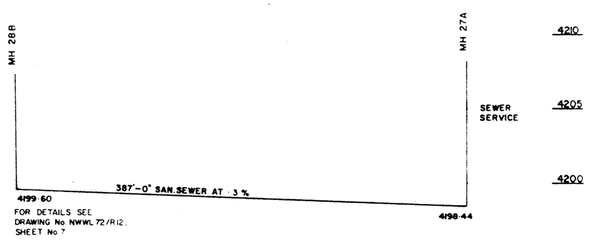



Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail nº
B location dwg. no. — s.sr dessin nº
C drawing no. — dessin nº

drawn by / tracé par: M. S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976
job captain / chef du projet — date
responsible officer / officier responsable — date

project title / titre du projet

WATERTON TOWNSITE

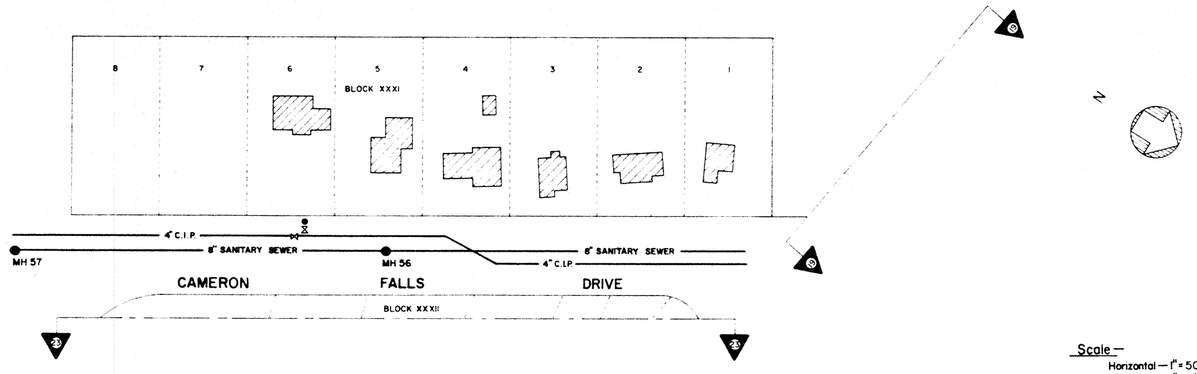
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin

PLAN & PROFILE -
WATERTOWN AVE.

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 23 of 31

IAND 56-81 (6-72) 7530-21-028-1218

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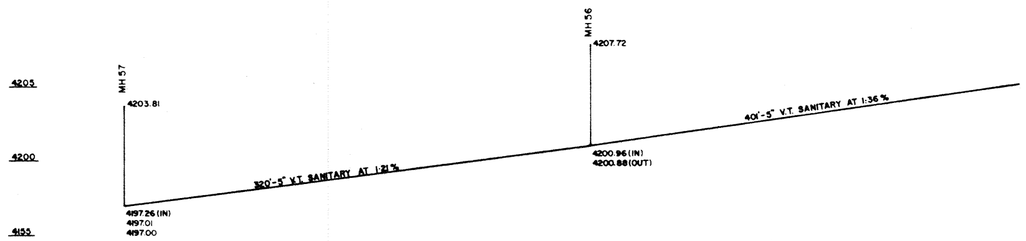



Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail nº
B location dwg. no. — sur dessin nº
C drawing no. — dessin nº

drawn by / tracé par: M. S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976

job captain / chef du projet — date

responsible officer / officier responsable — date

project title — titre du projet

WATERTON TOWNSITE

UTILITIES INVENTORY
(PHASE I)

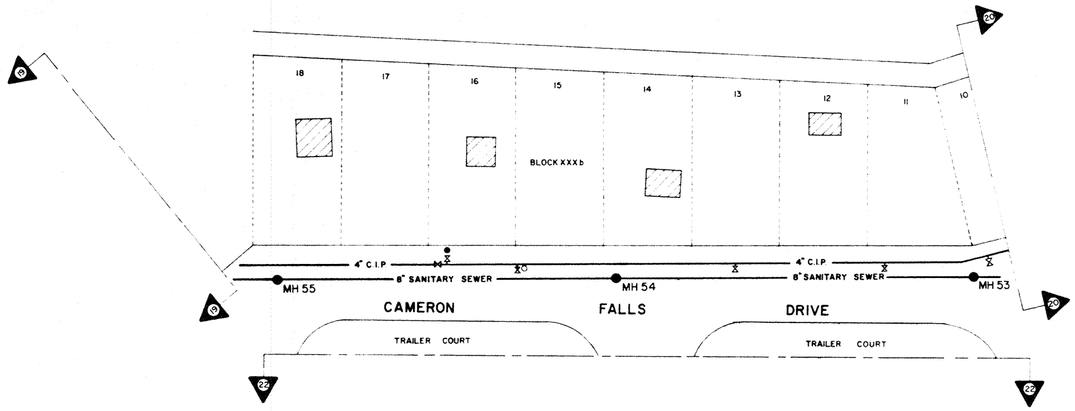
drawing title — titre du dessin

PLAN & PROFILE —
CAMERON FALLS DRIVE

reference no. / nº de référence: NWWL 76/R12

dwg no. / dessin nº: 24 of 31

IAND 56-81 (8-72) 7530-21-028-1218

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Scale
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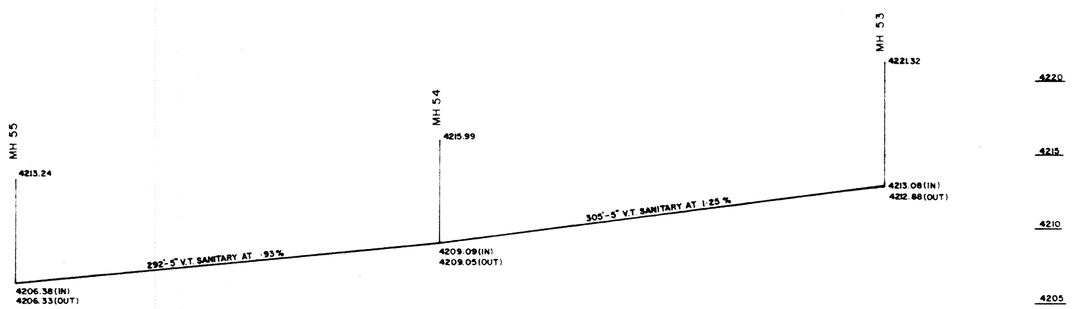
Vertical — 1" = 4'




Indian and Northern Affairs / Affaires indiennes et du Nord

revisions | date

A detail no. / détail no
B location dwg. no. / sur dessin no
C drawing no. / dessin no

drawn by / tracé par: M.S.
scale / échelle: as schown
designed by / établi par: G. Roach
checked by / vérifié par:

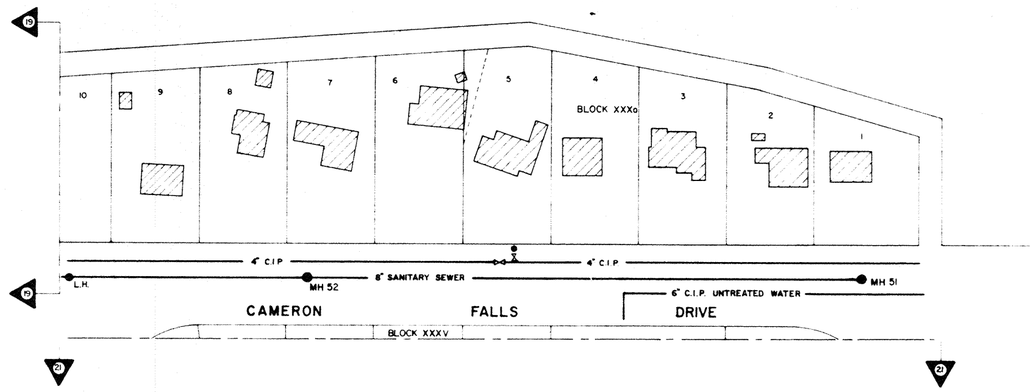
September, 1976
job captain / chef du projet | date
responsible officer / officier responsable | date

project title / titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin
PLAN & PROFILE
CAMERON FALLS DRIVE

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 25 of 31

IAND 88-81 (6-72) 7530-21-028-1218

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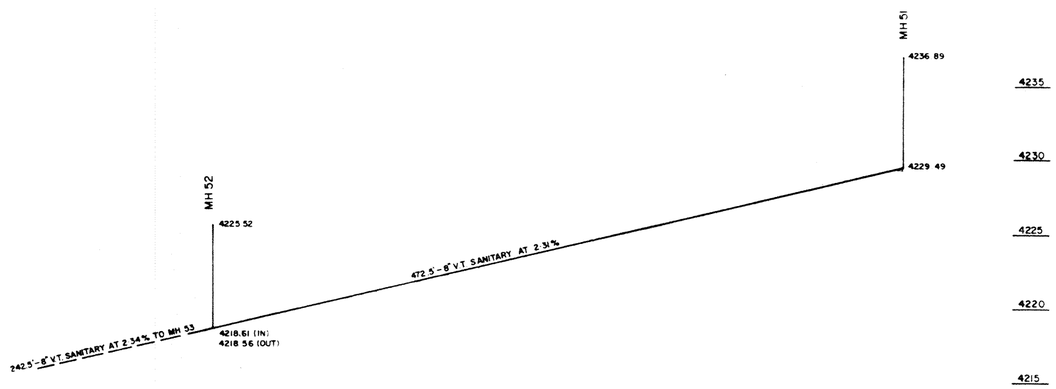
Vertical —— 1" = 4'




Indian and Northern Affairs / Affaires indiennes et du Nord

revisions | date

A detail no. / détail nº
B location dwg. no. / sur dessin nº
C drawing no. / dessin nº

drawn by / tracé par: M. S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976
job captain / chef du projet | date

responsible officer / officier responsable | date

project title / titre du projet

WATERTON TOWNSITE

UTILITIES INVENTORY

(PHASE I)

drawing title / titre du dessin

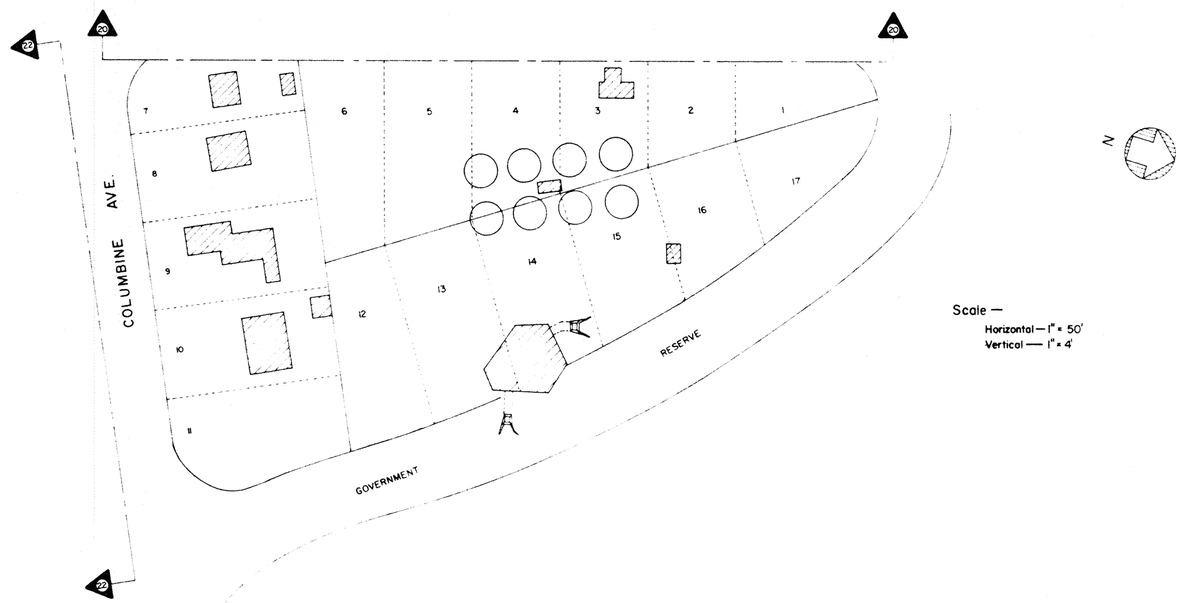
PLAN & PROFILE –

CAMERON FALLS DRIVE

reference no. / nº de référence: NWWL 76/R12

dwg no. / dessin nº: 26 of 31

IAND 88-81 (9-72) 7530-21-029-1218




Scale —
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Vertical — 1" = 4'

Indian and Northern Affairs
Affaires indiennes et du Nord

revisions | date

A detail no. / détail nº
B location dwg. no. / sur dessin nº
C drawing no. / dessin nº

drawn by / tracé par: M. S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

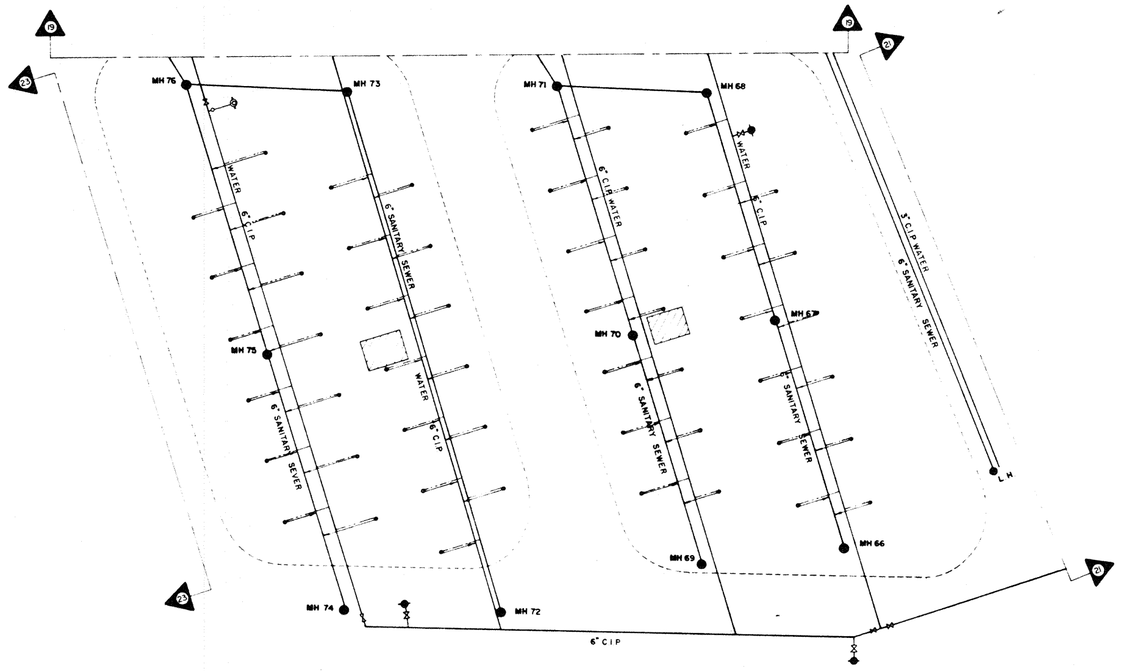
September, 1976
job captain / chef du projet | date
responsible officer / officier responsable | date

project title / titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin
PLAN & PROFILE
COLUMBINE AVE.

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 27 of 31

IAND 98-81 (9-72) 7530-21-029-1216

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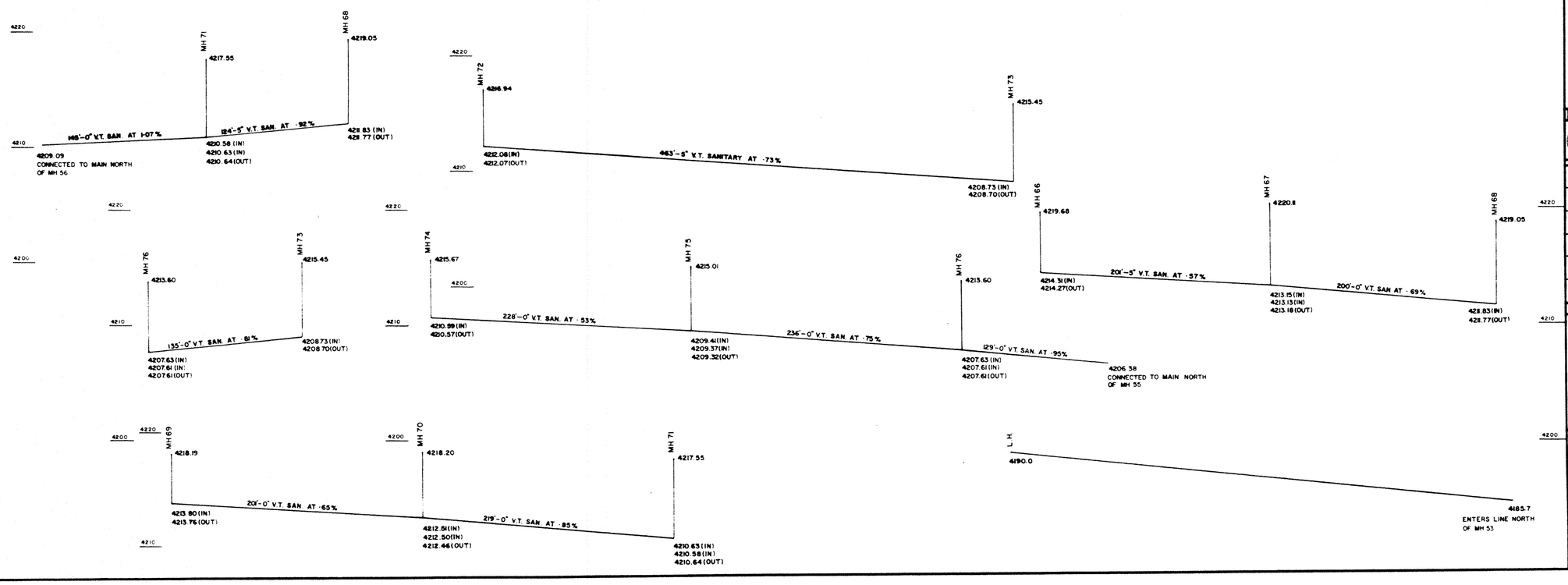
Vertical — 1" = 4'




Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail nº
B location dwg. no. — sur dessin nº
C drawing no. — dessin nº

drawn by / tracé par: M.S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976

job captain / chef du projet — date

responsible officer / officier responsable — date

project title — titre du projet

WATERTON TOWNSITE

UTILITIES INVENTORY
(PHASE I)

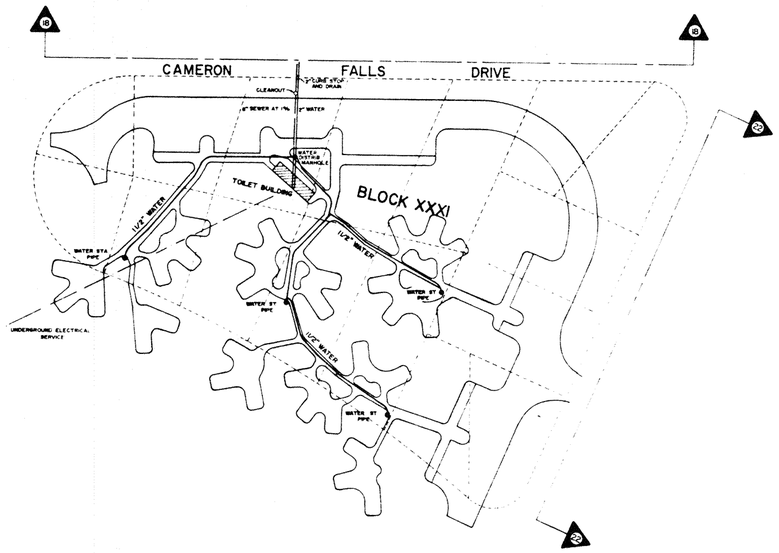
drawing title — titre du dessin

PLAN & PROFILE
TRAILER COURT (B SECTION), COLUMBINE AVE.

reference no. — nº de référence: NWWL 76/R 12

dwg no. — dessin nº: 28 of 31

IAND 88-61 (5-72) 7530-21-029-1218




N

Scale —
Horizontal — 1" = 50'
Vertical — 1" = 4'

Indian and Northern Affairs / Affaires indiennes et du Nord

revisions date

A detail no. détail nº
B location dwg. no. sur dessin nº
C drawing no. dessin nº

drawn by / tracé par: M.S.
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

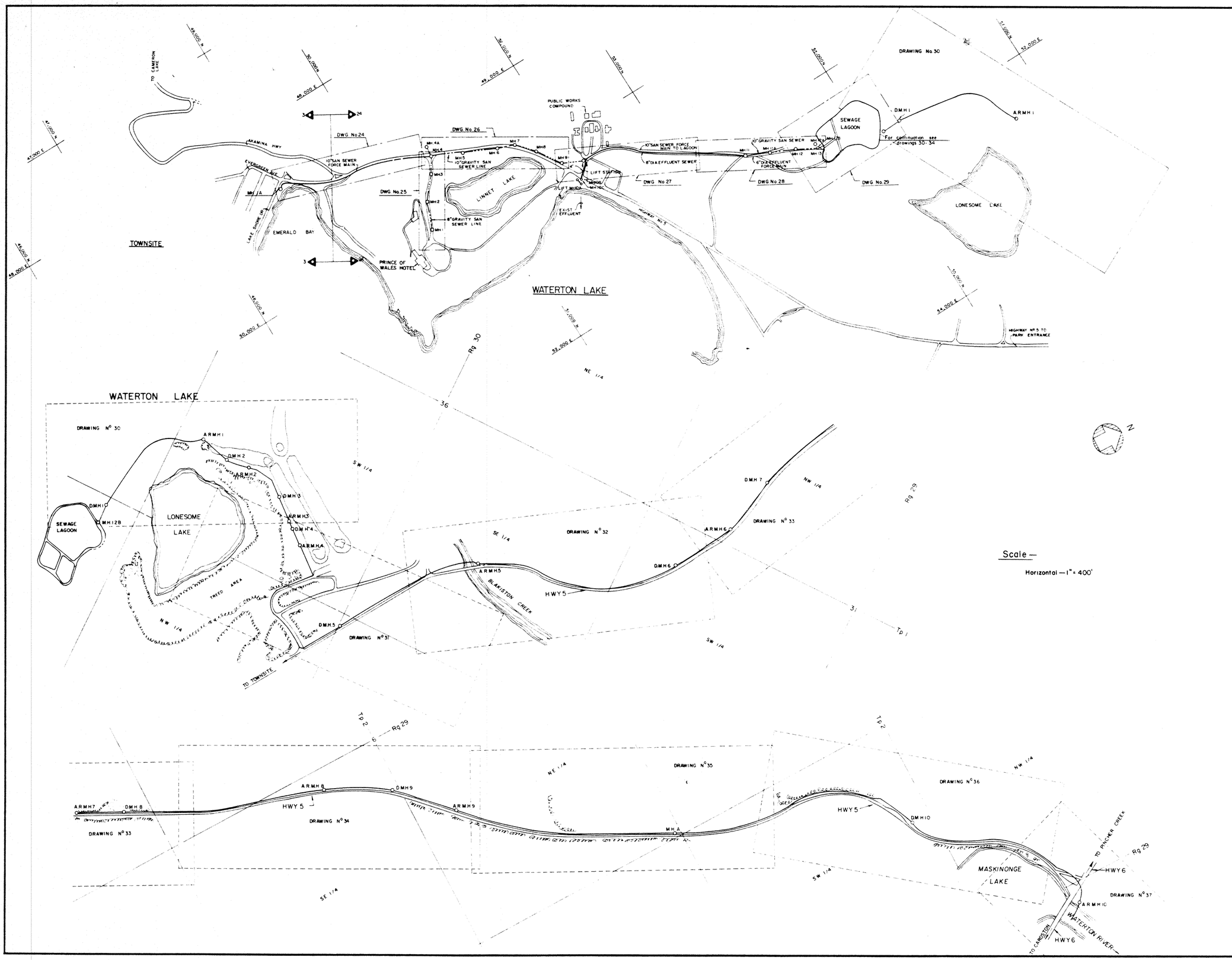
September, 1976
job captain / chef du projet date
responsible officer / officier responsable date

project title / titre du projet
WATERTON TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin
PLAN & PROFILE
TOWNSITE CAMPGROUND

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 29 of 31

IAND 88-81 (5-72) 7530-21-029-1210




Indian and Northern Affairs — Affaires indiennes et du Nord

revisions — date

A detail no. — détail no
B location dwg. no. — sur dessin no
C drawing no. — dessin no

drawn by / tracé par: R Mirkin
scale / échelle: as shown
designed by / établi par: G Roach
checked by / vérifié par:
September, 1976
job captain / chef du projet — date
responsible officer / officier responsable — date

project title — titre du projet
WATERTOWN TOWNSITE
UTILITIES INVENTORY
(PHASE I)

drawing title — titre du dessin
SEWAGE TREATMENT SYSTEM

reference no. — no de référence: NWWL76/R12
dwg no. — dessin no: 30 of 31

IAND 89-81 (5-72) 7530-21-688-1216

Indian and Northern Affairs
Affaires indiennes et du Nord

revisions | date

A detail no. | détail nº
B location dwg. no. | sur dessin nº
C drawing no. | dessin nº

drawn by / tracé par: R. Mirkin
scale / échelle: as shown
designed by / établi par: G. Roach
checked by / vérifié par:

September, 1976
job captain / chef du projet | date

responsible officer / officier responsable | date

project title / titre du projet
WATERTON TOWNSITE UTILITIES INVENTORY
(PHASE I)

drawing title / titre du dessin
DEVELOPMENT PLAN

reference no. / nº de référence: NWWL 76/R12
dwg no. / dessin nº: 31 of 31

IANÒ 88-81 (6-72) 7530-21-028-1218