



DEVELOPMENT PERMIT

I, Ifan Thomas, Superintendent, Waterton Lakes National Park of Canada, pursuant to the provisions of the regulations respecting buildings in the National Parks of Canada, do hereby permit

Parks Canada

To undertake development in the Waterton townsite in accordance with the development proposal for:

- **Street works and utility upgrades: Phases D and E**
- **Wayfinding signage and lighting upgrades**


This Development Permit is subject to the following condition and attached Schedule and to all National Park Regulations now in force or which hereafter may be made from time to time by the Governor-in-Council.

Condition:

- 1) Compliance with mitigations in the *Waterton Townsite Municipal Infrastructure Upgrades Phase D and E (WLNP-2017-031)* mitigation package is a condition of project approval and a requirement during project activities.

This Development Permit expires on the 31st day of March, 2020 and the authorized work must be completed on or before that date or all work in connection with same stopped until authority has been obtained for its completion.

Signed and dated at Waterton Park this 12th day of July, 2017


Ifan Thomas, Superintendent





DEVELOPMENT PERMIT Schedule A

Terms and Conditions:

1. The permit holder and a designated agent of the Superintendent shall be the respective contact personnel for the Project in regards to and in issues arising from the construction of the Project and the Terms and Conditions of the Development Permit.
2. The Permit holder is responsible to ensure that all Consultants, Contractors, Sub-Contractors, Suppliers and their respective employees are adequately informed and supervised to ensure compliance with the environmental protection requirements of this Project and the Terms and Conditions of the Development Permit. Contact the Environmental Assessment Office (403-859-5185) to schedule mandatory environmental briefings for all workers on the project. Any changes or amendments to submitted drawings or other information may require an amendment to the submitted Environmental Assessment (EA). Discovery of known or suspected contaminants shall be reported to Parks Canada immediately. In the event of suspected contaminants, all work shall cease until direction can be provided by Parks Canada.
3. All fill, including topsoil, that is going to be brought into the Park must now be inspected and approved **"At The Source"** prior to shipping. This applies to ALL projects carried out within the Park. Contact an Environmental Assessment Officer (403-859-5185) to arrange for an inspection.
4. All Consultants, Contractors, Sub-Contractors and Suppliers shall obtain a National Park business license prior to the commencement of their contracts or work in accordance with the National Park Business Regulations. Provide a list of Sub-Contractors to be employed in the construction of your development project to the Municipal Officer (403-859-5117).
5. All work associated with the Project must proceed according to working drawings and specifications noted above, as well as work descriptions and inspection reports submitted and approved by the Park Superintendent. Any changes to the project construction must be submitted and approved by the Superintendent.
6. Construction safety measures and actions as required by the Occupational Health and Safety Board, the Workers Compensation Board and all other applicable Federal and Provincial statutes and regulations are the responsibility of the permit holder and shall be enforced.





7. Construction activities and methods shall comply with the National Fire Code and all other applicable Fire Safety Requirements for Building Construction regulations or directives as issued by the Dominion Fire Commissioner.
8. The Contractor will confine all operations and procedures within the perimeter of the project site as approved by the Superintendent. The storage of construction equipment, material and waste must be contained and secured within the project site.
9. The Contractor shall ensure the disposal of all construction waste, including but not limited to; concrete, masonry, metal products, gyproc (drywall), wood, shingles, roofing materials and other waste material generated by the project, is entirely removed from the Park in suitable containers and conveyances. Waste shall not be deposited in the Parks Canada Transfer Station, community dumpsters nor at the "Burn Pit" located at Parks Canada's upper compound.
10. The site service locations must be confirmed prior to excavation.
11. Any cultural resources, including historic artifacts, shall be reported immediately to Parks Canada.
12. Inspection reports from inspection firm must be submitted and approved by Parks Canada to be provided by the leaseholder or the manager of the construction project. These reports must confirm that the project is being built to applicable codes and regulations, and to the conditions of approvals. The reports must be provided on a regular basis; firstly to confirm that they have reviewed the working drawings, excavation, foundation, and completion, as applicable, or once every month while the project is under construction. The reports must be prepared and signed by a professional architect, an engineer or a building inspector as certified by the Province of Alberta.
13. Any changes to the drawings as submitted on file without the knowledge of Parks Canada may cause approvals associated with this application to be null and void.





Parks Canada EIA Requirement Checklist

This template documents the initial analysis of the requirement for an EIA and is designed to be used with the EIA decision framework and a completed project description. Additional information (such as correspondence with local Parks Canada or other experts) can be appended as required. If you have any questions, please contact Jennifer.Carpenter@pc.gc.ca

Project Title: Waterton Townsite Municipal Infrastructure Upgrades Phase D and E

Project Location: Waterton Townsite

Project File #: WLNP-2017-031

Proponent Contact Information: Jim Lambe, 403-632-6043 and Mark Burke (PWGSC), 403-470-0855

Date of Request: 2017-06-20

Section A: No EIA Required

The project is exempted from EIA requirements under CEAA 2012 S. 70: (check the appropriate box)

- ☐ the project relates to matters of national security;
- ☐ the project is being carried out in response to a national emergency for which special temporary measures are being taken under the Emergencies Act; or
- ☐ the project is to be carried out in response to an emergency, and in the interest of preventing damage to property or the environment or in the interest of public health or safety.

The project is exempted from EIA requirements as the same project was previously assessed: (both boxes must be checked to apply this option)

- ☐ the previous EIA is adequate
- ☐ there is no change in information that would alter the results of the analysis.

The project is exempted from EIA requirements because an initial analysis has determined:

- ☐ there is NO potential for adverse effects to natural and cultural resources, including:
 - natural resources targeted in management objectives and ecological integrity monitoring indicators; listed species at risk, their residence or critical habitat. Additionally, the activity is not prohibited in a protection order under the Species at Risk Act.
 - cultural resources targeted in management objectives and identified in a Parks Canada cultural resource management document, or any structure, site or thing of historical, archaeological, paleontological or architectural significance.

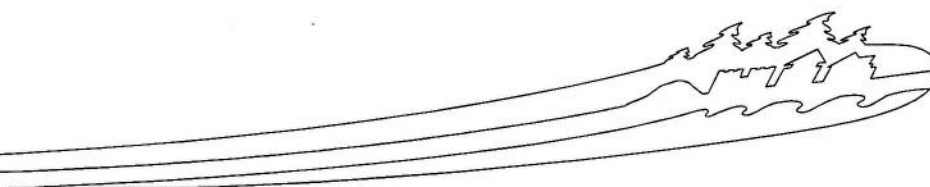
OR

- ☐ potential adverse effects of the project are exclusive to cultural resources (including potential archaeological resources), and the Cultural Resource Impact Analysis (CRIA) will be used to assess impacts and determine appropriate mitigation measures.

Provide a concise explanation to justify the decision.

Click here to enter text.

If you have exempted the project from an EIA requirement by selecting one of the three options above, **Proceed to Section D.**





Section B: EIA Pathway Decision

The EIA pathway to be applied to the proposed project is:

- ☐ an approved alternate process (must be approved by VP PAEC)
- ☒ one or more approved Best Management Practices (BMPs)
- ☐ a Basic Impact Analysis (indicate if one or more BMPs are also being used)
- ☐ a Detailed Impact Analysis (indicate if one or more BMPs are also being used)

Insert the name of the approved alternate process and/or applicable BMPs and Continue to Section C.

[Waterton Lakes National Park General Project Best Management Projects](#)

Section C: Permitting Requirements

Indicate the types of permits that may be required:

- ☒ Development/Building ☐ Lease/License of Occupation ☐ Water Withdrawal ☒ Business License
- ☐ Add others as required (Fisheries Act, Navigation Protection Act, SARA authorization, etc.)

Section D: Cultural Resource Requirements

Indicate the types of Cultural Resource Impact Assessment that may be required:

- ☐ A separate request for Cultural Resource Impact Assessment must be submitted.
- ☒ No additional assessment is required. The accidental finds mitigation applies to all project activities.
- ☐ Cultural Resources (including archaeology) will be included as a Valued Component of the BIA or DIA.
- ☐ Archaeological Overview or Impact Assessment is required.
- ☐ Additional mitigations related to Cultural Resources are indicated in section F below.

Section E: Recommendation and Approval

Prepared by (IAO name/position): [Jennifer Carpenter / Environmental Assessment](#)

Date: 2017-06-22

Reviewed by: [Dennis Madsen / Resource Conservation Manager](#)

Date:

2017/07/02

Recommended by (Project Manager name/position): [Joe Fontoura / acting Asset Manager](#)

Date:

4/7/17

Approved by (name of FUS, Director of a Waterway, or delegate):
[Ifan Thomas](#)

Date:

Signature (FUS, Director of a Waterway, or delegate):

Ifan Thomas
Superintendent

July 4/17

(Note that EIA decisions regarding highway and waterway projects identified in Parks Canada's Investment Program may require joint approval with Associate VP, Asset Management and Project Delivery; however, the FUS/Dir. of a Waterway is responsible for issuing permits and authorizations for those projects).



Section F: Additional Comments

Project includes municipal infrastructure repairs on Harebell Road, Alley 5, Alley 4, Alley 2, Clematis Avenue, Fountain Avenue, Vimy Avenue, Waterton Avenue, and Mt. View Road.

Project scope also includes postponing restoration of the disturbed area at the corner of Vimy and Clematis from the end of phase C (Project # WLNP-2016-17) to the end of phase D & E. This delay allow flexibility and efficiencies between the Project phases as this lay down space can be available during the final project phases without compromising the final rehabilitation. Supplemental mitigations are included in the BMP to ensure the delay does not compromise the quality of final rehabilitation.

Section G: Attachments

Waterton Lakes National Park General Project Best Management Practices filled out for project WLNP-2017-031
Communication outlining archaeological review requirements





Mitigation Package

<Update this page for individual projects>

Parks Canada Waterton Lakes National Park General Project Best Management Practices

Recommendation & Approval – Version 2.0

Modified for: WLNP-2017-031

Contact Information

Project Manager:

Jim Lambe: 403-632-6043

Impact Assessment Office: 403-859-5185

Jennifer Carpenter: 403-632-5167

Eri Hiraga: 403-632-6071

Erin Rowlands: 403-632-5046

Parks Canada Emergency Dispatch:

Banff Dispatch: 403-762-1473

First Contact Authority (for SPILLS):

First Contact Authority: 780-422-4505

OR 1-800-222-6514

24-hour Emergency Dispatch*:

Police, Fire, Ambulance: 9-1-1

* In an Emergency, 9-1-1 operators can also notify Banff Dispatch.



1. Supplementary Mitigations

Include any supplemental, or site-specific mitigations

- For Townsite applications, process topsoil prior to stockpiling and all salvaged topsoil must be used prior to import of topsoil. Any topsoil import requires inspection and written approval from the surveillance officer (SO). Import of topsoil shall be kept to the minimum necessary and only from approved sources.
- 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. Application of seed and mulch must occur within 1 week of topsoil placement.
- In previously disturbed lawn areas of the Waterton Community, consider using sod rather than seeding for high traffic areas or places that need extra erosion control.
- Where necessary, temporary fencing or placing rocks may be required to prevent visitors from driving over seeded areas.
- Planted trees must be fenced to protect them from damage from wildlife.
- The previously disturbed area at the corner of Clematis Avenue and Vimy Avenue is within the Environmental Reserve District. With approval from the SO, this location may be used as a staging area during the Project, however the Prime Contractor may not extend the disturbance beyond its current boundaries. The Prime Contractor is responsible to ensure the boundaries of this site remain clearly marked for the duration of the Project, and that the site is rehabilitated to the satisfaction of the Surveillance Officer. This site may be suitable for the planting of replacement trees.



2. Environmental Surveillance

- 2.1. 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.
- 2.2. 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.
- 2.3. 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.

3. 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

- 3.1. 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.

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.

- 3.2. Incorporate lights that shut-off automatically to promote energy efficiency and reduce night time bird collisions.
- 3.3. Minimize use of unnecessary reflective or transparent materials in building design.
- 3.4. 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).
- 3.5. Appropriately screen chimney and ventilation shafts to avoid attracting cavity roosting birds or bats to risky locations.
- 3.6. Appropriately screen all water intakes to prevent amphibian and fish mortality.



Wildlife Habitat & Movements

- 3.7. 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).
- 3.8. 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).
- 3.9. 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).
- 3.10. For gated/fenced areas, provide escape routes such as leaving 45 cm clearance under gates.
- 3.11. 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

- 3.12. 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

- 3.13. Design includes materials and technologies that minimize environmental impacts through the lifecycle of the material.
- 3.14. Design incorporates energy efficiency, reduction of greenhouse gases and environmental design best management practices (e.g., LEED criteria).
- 3.15. Minimize water use and incorporate water meters in buildings over 1000 m².

Project Footprint & Siting

- 3.16. Avoid sensitive features and apply appropriate setbacks.
- 3.17. 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.
- 3.18. Minimize visual impact of site layout, access routes and construction activities.
- 3.19. Locations are compatible with any zoning requirements (e.g., avalanche paths, wilderness zone).
- 3.20. Design minimizes the area and/or impact of disturbance.
- 3.21. Design and plan activities and works near watercourses and waterbodies to minimize disturbance to aquatic habitat and avoid sensitive spawning habitats.



- 3.22. Design and construct approaches to a watercourse perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation.
- 3.23. 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

- 3.24. Minimize runoff into water bodies; direct runoff and storm water into vegetated areas rather than directly into surface waters.
- 3.25. Avoid designs and construction practices that result in long, smooth, uniform slopes and may contribute to erosion or sediment transfer.
- 3.26. Apply appropriate standards for all septic field, pit privy, and other waste water management at facilities.
- 3.27. 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

- 3.28. 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

- 3.29. Project planning and design minimize the disturbance to surrounding vegetation as much as is feasible.
- 3.30. Project planning incorporates opportunities to restore or use existing disturbed areas.
- 3.31. 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](#)).
- 3.32. A Landscape Restoration Plan shall be developed prior to construction as part of a landscape drawing construction package. The Landscape Restoration Plan shall consider the following:
 - Site objective and intended use;
 - Site design and implementation to be detailed in the plan. The implementation may be executed in stages;
 - Amount and Type of human use within and movement through the site;
 - Site-specific soil, wind, vegetation and/or wildlife concerns;
 - Site hydrology, including flood potential and/or drainage concerns;
 - Identification of potential contamination issues and methods for resolution;
 - Erosion and sediment control requirements for locations near waterbodies or along slopes. Site to be monitored to determine requirements for short- or long-term measures; and
 - Maintenance and monitoring requirements.



Pre-Construction Surveys

- 3.33. 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.
- 3.34. 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	<input type="checkbox"/>	
Hazardous Materials Survey	<input type="checkbox"/>	
Reconnaissance Site Visit	<input type="checkbox"/>	
Rare Plant Survey	<input type="checkbox"/>	
Wetland Survey	<input type="checkbox"/>	
Wildlife Survey (list types)	<input type="checkbox"/>	
Fish Assessment	<input type="checkbox"/>	
Soils / Geotechnical	<input type="checkbox"/>	
Cultural Resources (list type)	<input type="checkbox"/>	
AOA / AIA	<input type="checkbox"/>	Parks Canada archaeologist Gwyn Langemann advises that no AOA is required.
Water/Air Quality	<input type="checkbox"/>	
Visitor Experience	<input type="checkbox"/>	
Weed Survey	<input type="checkbox"/>	
Other	<input type="checkbox"/>	

4. Submissions

- 4.1. Check box of attachments / plans required prior to the start of construction.

Attachments / Plans	Required	Responsible Party	Reviewer and Submission Deadline
Environmental Alignment Sheets	<input type="checkbox"/>		
Erosion and Sediment Control Plan	<input checked="" type="checkbox"/>	Prime Contractor	Prime contractor shall review their erosion and sediment control plan with the Surveillance Officer and Project Manager prior to initiating project works.
ERP (Emergency Response Plan)	<input checked="" type="checkbox"/>	Prime Contractor	Prime contractor shall review their Emergency Response Plan with the Surveillance Officer and Project Manager prior to initiating project works. The ERP must address spill response, fire contingency and avalanche safety as appropriate for the project works.



Spill Response Plan	<input checked="" type="checkbox"/>	Prime Contractor	Prior to initiating project works.
Fire Contingency Plan	<input checked="" type="checkbox"/>	Prime Contractor	Prior to initiating project works.
Avalanche Safety Plan	<input checked="" type="checkbox"/>	Prime Contractor	Prior to initiating project works. (If work in avalanche zones is scheduled)
Site-specific Mitigation Details	<input type="checkbox"/>		
Restoration Plan	<input checked="" type="checkbox"/>	Prime Contractor	Prime contractor must outline their soil handling procedures and reseeding schedule to the Surveillance Officer and Parks Canada Project Manager prior to initiating project works. No topsoil stripping can begin until the restoration plan is accepted.
HDD or Geotechnical Drill Plan	<input checked="" type="checkbox"/>	Prime Contractor	All drilling activities require a Restricted Activity Permit. Contact the Environmental Assessment Office at least 5 days prior to the drilling activity to apply for a drilling permit.

5. Environmental Alignment Sheets

- 5.1. 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.

6. Erosion and Sediment Control Plan

- 6.1. An Erosion and Sediment Control Plan (ESCP) will be prepared that covers all construction and restoration periods.
- 6.2. 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.
- 6.3. The Erosion and Sediment Management Plan will be developed by a qualified professional and is subject to approval of the IAO.

Timing of Works

- 6.4. Schedule work to avoid extreme wet, windy and rainy periods that may increase erosion and sedimentation.
- 6.5. 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

- 6.6. Erosion control measures that prevent sediment transport into any waterway, water body or wetland shall be implemented by the contractor.



- 6.7. 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).
- 6.8. 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).
- 6.9. Acquire necessary erosion and sediment control equipment (i.e., landscaping fabric, sediment fences, coir rolls etc.) and install prior to risk of sediment transport.
- 6.10. 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.
- 6.11. Plan project activities to minimize soil handling.
- 6.12. Limit equipment movement over exposed soils.
- 6.13. Avoid activities that contribute to soil compaction and use practices that roughen and decompact soils to promote infiltration.
- 6.14. Ensure all activities are conducted at least 30 m from waterbodies wherever possible.
- 6.15. Minimize extent of vegetation cover removal and grubbing. Clearly mark construction boundaries to prevent accidental damage to vegetation.
- 6.16. 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.
- 6.17. Minimize the length of time soils are exposed and complete work in one area before commencing work in another area.
- 6.18. 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.
- 6.19. Initiate replanting of disturbed areas immediately after construction is completed.
- 6.20. Ensure all erosion and sediment control devices are weed free. Straw and hay based erosion control is not permitted.
- 6.21. Avoid use of coconut matting due to ungulate hoof entrapment.
- 6.22. 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.
- 6.23. The site will be secured against erosion during any periods of construction inactivity or shutdown.
- 6.24. 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

- 6.25. 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.

7. Emergency Response Plan Module

- 7.1. The general emergency contact for WLNP is 9-1-1.

Spill Response Plan

- 7.2. 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 LAO.
- 7.3. 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).
- 7.4. 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

- 7.5. Avoid work in high risk areas, particularly in areas of high water table, steep slopes or in close proximity to streams.
- 7.6. Have spill containment equipment on-hand and ensure that all personnel are aware of their location and trained in their use.
- 7.7. Absorbent booms must be immediately available on site during works in and near water.
- 7.8. 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.
- 7.9. 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.
- 7.10. 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).
- 7.11. Hazardous or toxic products shall be stored no closer than 100 metres from streams, wetlands, water bodies or waterways.
- 7.12. Equipment will be fuelled on hardened surfaces wherever possible.
- 7.13. Spill kits shall be provided at re-fuelling, lubrication, and repair locations.
- 7.14. 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.



- 7.15. 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.
- 7.16. All gas generators and water pumps require secondary containment. Electric pumps are preferred.
- 7.17. Follow all applicable regulations and codes for the management and handling of hazardous waste.
- 7.18. 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.
- 7.19. 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.
- 7.20. The SO shall be notified immediately of any spill. In the event of a major spill, Banff Dispatch (403-762-1473) shall be notified immediately along with the First Contact Authority (1-800-222-6514).

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. > 100 L, immediately notify the SO and Banff Dispatch.	At the discretion of the SO. Major Spill if not contained. Required; Major Spill

Minimum Requirements

- 7.21. 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

7.22. 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

- 7.23. 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.
- 7.24. Fires or burning of waste materials is not permitted.
- 7.25. 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.
- 7.26. Where an emergency fire contingency plan has been requested, the prime contractor should provide, at minimum the required equipment as defined in the Schedule of the *Alberta Forest and Prairie Protection (Ministerial) Regulation*.
- 7.27. 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 1 Adapted Alberta Forest and Prairie Fire Protection (Ministerial) Regulations AR 65/2017, Schedule

Required Equipment for Fire Control	People Employed at the Site of Operations									
	1	2	3	4	5	6-10	11-20	21-30	31-40	41+
Shovels	1	1	2	2	3	5	10	15	20	Same as 31-40 plus increase as required by
Back-pack with pump	1	1	1	2	3	5	10	15	20	
Axe or Pulaski	1	1	1	1	2	5	10	15	20	



Fire pump	0	0	0	0	0	0	0	1	1	SO in consultation with the Parks Canada Fire Management Officer.
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

- 7.28. 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.
- 7.29. 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.
- 7.30. If the avalanche safety plan is drafted by the Prime Contractor, it must be approved by Parks Canada Avalanche Forecasters.
- 7.31. In some situations the Prime Contractor may be permitted 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.
- 7.32. 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.

8. 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.

- 8.1. 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.
- 8.2. 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

- 8.3. 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.
- 8.4. 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).
- 8.5. All Parks Canada designated speed limits apply to construction vehicles. Additional speed restrictions may be required to protect wildlife and visitor safety.



WLNP General Project Best Management Practices

	Required	Location(s)	Notes
Additional Speed Limits	<input checked="" type="checkbox"/>	Waterton Village, Access Routes	Additional speed limits may apply, as determined by working conditions, weather, and location and at the discretion of the SO or departmental representative.
Work Hour Restriction	<input checked="" type="checkbox"/>	Waterton Village	Additional work hour restrictions may apply, as determined by working conditions, weather, and location and at the discretion of the SO or departmental representative.
Designated Truck Routes	<input checked="" type="checkbox"/>	Waterton Village, Access routes inside WLNP	Additional restrictions on access routes may apply, as determined by working conditions, weather, and location and at the discretion of the SO or departmental representative.

Timing Windows

- 8.6. 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	<input checked="" type="checkbox"/>	April 1 to August 31	Nesting survey(s) to be completed by SO prior to any tree removal in this period. All tree removal requires Restricted Activity Permit and 3:1 compensation.
Bat Maternity Roost Activity Period	<input checked="" type="checkbox"/>	April 1 to August 31	Bat roost survey(s) to be completed by SO prior to any tree removal in this period. All tree removal requires Restricted Activity Permit and 3:1 compensation.
Bat General Activity Period	<input checked="" type="checkbox"/>	April 1 to October 31	Bat roost survey(s) to be completed by SO prior to any tree removal in this period. All tree removal requires Restricted Activity Permit and 3:1 compensation.
Amphibian Calling Window	<input type="checkbox"/>	April 15 to June 15	
Bull Trout Restricted Work Periods	<input type="checkbox"/>	August 31 to August 15	
Other Fish Species Restricted Work Periods	<input type="checkbox"/>	Consult IAO	
Grassland Dormancy	<input type="checkbox"/>	October 1 to February 28	
Additional Timing Considerations (e.g., weed seed set, soil protection)	<input type="checkbox"/>	Dry late summer and fall conditions	

Work Site Conditions/Staging/Laydown

- 8.7. Minimize vegetation-clearing activities and ground disturbance by staging on existing hardened areas wherever possible.
- 8.8. Delineate the work zone; clearly mark the limits to active construction, sensitive features and the access and egress locations.



- 8.9. The Prime Contractor is responsible for security and safety of the work site.
- 8.10. Strong winds are a regular occurrence in WLNP. Prevent materials from blowing off of work site.
- 8.11. If contamination is found, cease work immediately and if necessary, implement Emergency Response Plan.

Wildlife Observations and Encounters

- 8.12. 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.
- 8.13. 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.
- 8.14. If potentially dangerous wildlife (e.g., bear, cougar, wolf, deer, sheep) persistently enter the work area or display aggressive behaviour, the contractor will immediately stop work, notify 9-1-1 or Banff Dispatch (1-888-WARDENS), and safely evacuate the area.
- 8.15. Contractor will make bear spray, bear spray training, and wildlife awareness training mandatory to all workers on site.
- 8.16. Secure all materials that might attract wildlife (e.g. petroleum products, human food, recyclable food and drink containers and garbage).
- 8.17. 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

- 8.18. Equipment movements and workers' private vehicles shall be restricted to the designated footprint of the construction area.
- 8.19. Protective measures, including using appropriately sized equipment, or protective access matting must be employed if entry into wet areas is required.
- 8.20. 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.
- 8.21. 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?	<input type="checkbox"/>		



- 8.22. Inspect equipment daily for fluid/fuel leaks and maintain equipment in good working order.
- 8.23. 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.
- 8.24. Mobile fuel containers (e.g., slip tanks) shall remain in the service vehicle at all times.
- 8.25. 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.
- 8.26. 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*.
- 8.27. 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.
- 8.28. 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.
- 8.29. 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

- 8.30. All small equipment (e.g., chainsaws, mowers, etc.) should be kept in good working condition and free of oil and fuel leaks.
- 8.31. Where possible, chain oil should be vegetable-based.
- 8.32. Fuelling of chainsaws will take place outside of riparian areas and sensitive features.

Site Clean Up/Waste Disposal

- 8.33. Clean tools and equipment at an appropriate off-site facility to prevent the release of wash water that may contain deleterious substances.
- 8.34. 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.
- 8.35. 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.
- 8.36. 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.
- 8.37. 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.



- 8.38. 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.
- 8.39. Camping and other recreational activities at the work site by contractors is not permitted without prior approval from the IAO and the Project Manager. These activities, if deemed appropriate, are conditional upon specific mitigations that address risks to wildlife, safety and any other additional environmental effects.

Air Quality Mitigations

- 8.40. Diesel equipment used on the project shall be fuelled with low sulfur diesel fuels and shall conform to local emission requirements.
- 8.41. Minimize idling of engines at all times.
- 8.42. Schedule dust generating activities during periods with lower wind speeds.
- 8.43. Ensure fine materials being transported are covered and protected.

Cultural Resources

- 8.44. 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.
- 8.45. Where deep excavation is planned within the townsite, notify the Parks Canada Terrestrial Archaeology section to coordinate a site visit to look at the subsurface deposits with buried soils whenever possible.
- 8.46. If applicable, follow additional mitigations outlined in the Cultural Resources Impact Assessment.

	Required	Location(s)	Notes
Are additional mitigations for cultural resources required?	<input type="checkbox"/>		

9. 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](#).

- 9.1. 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 [appendices](#) for regulatory guidance and 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.
- 9.2. 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.
- 9.3. 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 may be 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

- 9.4. Where ground disturbance accompanies vegetation removal, time activities to minimize soil handling, soil compaction, and erosion potential. Avoid extreme dry windy and wet conditions.
- 9.5. In areas with weed infestations, reduce weed spread through vegetation removal prior to seed set.

Vegetation Removal Mitigations

- 9.6. If previously unidentified sensitive features are found during construction, immediately stop work and notify the SO (e.g., raptor nest).



- 9.7. 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.).
- 9.8. Minimize full removal and retain vegetation when possible to reduce erosion.
- 9.9. 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.
- 9.10. Do not deposit debris in water bodies.
- 9.11. 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

- 9.12. 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.
- 9.13. 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.
- 9.14. Ensure tree limbs/stumps are flush cut as close to the ground or stem as possible.
- 9.15. Fallers should assess each tree individually for critical wildlife features such as nests or cavities. Notify the SO if unexpected features are identified.
- 9.16. 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.
- 9.17. 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.
- 9.18. 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.
- 9.19. 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.
- 9.20. Where possible, preserve identified wildlife trees by limbing or topping if they are not assessed as hazard trees.

Disposal of Vegetation Debris

- 9.21. 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.
- 9.22. 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.
- 9.23. If temporary storage is required, store debris on already disturbed areas to minimize footprint of disturbance.



- 9.24. All vegetation containing non-native species will be bagged and removed off site to disposal facility.
- 9.25. 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.
- 9.26. 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.
- 9.27. 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)

- 9.28. No burning of materials is permitted by non-PCA contractors.
- 9.29. Piles will be made where trees are felled, piles will be 1.2-1.8 (4 to 6 feet) in diameter and no more than 1.2 m (4 feet) high (approximately 1 to 3 trees per pile) or as outlined in an approved Burn Plan.
- 9.30. Piles are to be located so that they do not scorch surrounding live trees and measures must be in place to ensure that fires do not spread (i.e., conduct burning on snow or on mineral soil).
- 9.31. Piles will be left until fall for burning to allow for curing of green fuels.
- 9.32. Provincial regulations for air quality must be met.
- 9.33. Where fire fuel loading is not a concern, vegetation debris of limited amounts will be dragged in the forest to mimic natural tree fall. Materials will not be dragged through wetlands or other sensitive features.

Herbicide Use

- 9.34. 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.

10. 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](#).

- 10.1. All soil handling activities require consideration of erosion and sediment control.
[See ESCP Section.](#)

Soil Stripping

- 10.2. No stripping shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest.



- 10.3. 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.
- 10.4. 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

- 10.5. Salvage topsoil at all excavation sites for restoration purposes.
- 10.6. Prevent loss of topsoil through wind or water erosion.
- 10.7. 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.
- 10.8. 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.
- 10.9. 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

- 10.17. All trenches or ditches left unattended overnight must be fenced or covered to prevent wildlife entrapment or provide appropriate egress for wildlife.
- 10.18. 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.
- 10.19. 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.
- 10.20. Special precautions may have to be taken during excavation in the vicinity of intermittent or active drainage channels.
- 10.21. 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.
- 10.22. Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation.
- 10.23. To limit over compaction, use equipment which minimizes surface disturbance including low ground pressure tracks/tires, blade shoes and brush rake attachments.
- 10.24. All excavations will remain free of water (see [dewatering mitigations](#)).



Excavated Material Storage

- 10.25. 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.
- 10.26. 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).
- 10.27. 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.
- 10.28. 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.
- 10.29. Construct barricades to prevent losses on steep terrain ($>18^\circ$, 3:1).

Excess Materials and Waste (Overburden Removal)

- 10.30. 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.
- 10.31. Surplus excavated material may be used to fill depressions around the project site providing topsoil is stripped before filling, with approval from SO.

11. 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

- 11.1. Develop restoration plan as part of the project scoping and specifications prior to project approvals.
- 11.2. Ensure that the appropriate restoration materials are available as needed immediately following construction activities.
- 11.3. The restoration plan will be subject to the approval of the IAO, who will be responsible for consulting with the Park Vegetation Ecologist.
- 11.4. 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

- 11.5. Complete initial seeding as soon as possible.
- 11.6. 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.
- 11.7. Time weed control measures to prevent seed propagation.

Topsoil Replacement

- 11.8. Implement restoration plan for the disturbed area immediately following completion of construction.
- 11.9. Minimize soil movement and handling to protect existing native seed bank.
- 11.10. Replace topsoil to all areas immediately following fine grading.
- 11.11. Do not compact topsoil.
- 11.12. Backfilling should allow settling to prevent depressions however, long term roach piles on linear disturbances should be minimal.
- 11.13. 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.
- 11.14. 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.
- 11.15. Where remaining soils are unstable due to steepness or soil characteristics, immediate installation of sod or other erosion control is required.
- 11.16. 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

- 11.24. Avoid use of fertilizer to limit non-native vegetation growth and allow for local species to use available nutrients.
- 11.25. If needed use locally sourced mycorrhizae compost teas to improve vegetative success, as approved by WLNP vegetation ecologist.

Topsoil substitute

- 11.26. Apply an organic cellulose only amendment as a soil substitute if restoration standards are not being met within the defined time frame.
- 11.27. 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

- 11.28. 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.
- 11.29. 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.
- 11.30. 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.
- 11.31. Align cleat marks at right angles on slopes to trap seed and sediment and reduce erosion.

Species Selection

- 11.32. 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

- 11.33. A prescriptive seed mix appropriate for the project area will be provided by Parks Canada. If an appropriate seed mix is not available, the SO will contact the Park Vegetation Ecologist to determine an appropriate mix for the Project.
- 11.34. 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.
- 11.35. 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.
- 11.36. All seed is subject to testing by PCA prior to use.



Seeding

- 11.37. Use only seed purchased after written approval is obtained.
- 11.38. 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.
- 11.39. In previously disturbed lawn areas of the Waterton Community, consider using sod in high traffic areas or places that need extra erosion control.
- 11.40. Use temporary seeding when outside the seeding dates for permanent vegetation.
- 11.41. Apply a seed mixture which is appropriate for the climate, soil, and drainage conditions of the site.
- 11.42. Apply seed at a rate appropriate to the seed mixture, seeding method and existing vegetation conditions.
- 11.43. Conduct broadcast seeding under calm wind conditions. Hydro-seeding is acceptable where access is available.
- 11.44. Do not increase the seeding rate to compensate for poor seedbed conditions.
- 11.45. Monitor temporary erosion control measures to prevent seed loss.
- 11.46. Supplemental seeding may be required in subsequent years.

Alternatives to Seeding

- 11.47. Use topsoil seed bank in small areas when there is no risk of erosion or competition from invasive species (i.e., natural regeneration).
- 11.48. Use native transplants in areas where conventional seeding applications are not applicable or where slope stability is an issue.
- 11.49. Use native transplants to provide additional diversity and structure to supplement seeding.
- 11.50. Use conventional forestry planting methods for container grown transplants, see [website](#) for guidance.

12. Slope Stabilization, Drilling and Blasting Mitigations Module

Where standard excavation is not sufficient, scaling, hydraulic hammers, drilling units or trim blasting are used to break up rock or soil for removal. Accumulations of debris in ditches reduce their effectiveness at trapping rock fall and reduce public safety. Ditches will be cleaned using a loader and back hoe. Guardrails and rock fences may be temporarily removed to permit this activity.

Timing of Works

- 12.1. Follow timing windows as specified under the Vegetation Removal Mitigation Module.

Slope Stabilization-Scaling, Hydraulic Hammers

The use of hydraulic hammers attached to excavators is considered the ideal solution for rock disintegration. It avoids rock blasting where the parent rock is no longer rippable by the excavator's bucket but still has enough planes of weakness for economical operation and effective use of the hydraulic hammer. Scaling is the manual removal of loose material on rock



slopes using pry bars, hydraulic press, brooms, shovels and power equipment operated by personnel using roped access to a rock face.

- 12.2. For vegetation clearing refer to the [vegetation removal mitigation module](#) of this BMP.
- 12.3. For slope-stabilization in soils, please refer to the [ESCP](#) and [Excavation](#) section.
- 12.4. Measures shall be taken to control dust as much as possible during the removal and falling of rock materials down slope.
- 12.5. Placement of rip rap and backfill on sensitive features shall be undertaken without contacting the feature, in particular, not be below the High Water Mark.
- 12.6. If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately- sized, clean rock is used, and rock is installed at a similar slope to maintain a uniform bank.
- 12.7. Direct concentrated surface water (runoff) away from cut and fill slopes.
- 12.8. Immediately stabilize banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through vegetation restoration with native species suitable for the site-refer to [soil and vegetation restoration section](#) of BMP.

Drilling and Blasting for Slope Stabilization and Geotechnical Investigations

Trim blasting is used for controlled blasts in which explosive charges are placed in predetermined pattern of holes drilled into the rock face and then detonated. Potentially unstable masses of rock can sometimes be stabilized using rock bolts and long steel rods drilled into the rock to bind it together. Drilling is a common method of investigation to obtain geotechnical reports required for engineering design.

Drilling (General)

- 12.9. The contractor for geotechnical investigations must obtain a Restricted Activity Permit from the IAO prior to the commencement of work (see [Geotechnical](#) section).
- 12.10. Debris from drilling will be contained (screened or settle out) so it will not cover the surrounding area or enter any water course. All debris will be removed, see section on [overburden removal](#) for further mitigations.
- 12.11. The cuttings from all drilling will be contained so they can be removed entirely from the site. If contaminated, the cuttings are to be disposed at an approved waste disposal facility.
- 12.12. Control of spoil and sediment loaded water is required on the drill site. Dyking will be required to retain the deposit on non-vegetated surfaces. If contaminated, the spoil pile must be disposed at an approved waste disposal facility.
- 12.13. During aquifer tests, the water must be piped so it does not erode any soil or any part of the ground. If the water from the tests is piped to a creek, stream, or river, the pipe is to be situated so that there is no erosion of the stream bank or bed. If any sand or similar material is discharged during the aquifer test, care must be taken that the sand does not cover any vegetation.



- 12.14. All test wells will be filled in after the testing is completed. The proponent will be responsible for rectifying any future problems associated with any of the wells or test wells.

Blasting

- 12.15. The Parks Canada Representative will identify a magazine location for explosives should a factory site or "ready-to-use" explosives storage site be required
- 12.16. The blasting supervisor will ensure no damage to infrastructure, people, surrounding vegetation or wildlife by mitigating risk of fly rock.
- 12.17. Avoid using explosives in or near water. Use of explosives in or near water produces shock waves that can damage a fish swim bladder and rupture internal organs. Blasting vibrations may also kill or damage fish eggs or larvae.
- 12.18. If explosives are required as part of a project (e.g., removal of structures such as piers, pilings, footings; removal of obstructions such as beaver dams; or preparation of a river or lake bottom for installation of a structure such as a bridge or culvert), the potential for impacts to fish and fish habitat will be minimized by implementing the following measures:
- Time in water work requiring the use of explosives to prevent disruption of vulnerable fish life stages, including eggs and larvae, by adhering to appropriate fisheries **timing windows** under general activities.
 - Isolate the work site to exclude fish from within the blast area by using bubble/air curtains (i.e., a column of bubbled water extending from the substrate to the water surface as generated by forcing large volumes of air through a perforated pipe/hose), cofferdams or aquadams.
 - Remove any fish trapped within the isolated area and release unharmed beyond the blast area prior to initiating blasting.
 - Minimize blast charge weights used and subdivide each charge into a series of smaller charges in blast holes (i.e. Decking) with a minimum 25 millisecond (1/1000 seconds) delay between charge detonations (see Figure 1).
 - Back-fill blast holes (stemmed) with sand or gravel to grade or to streambed/water interface to confine the blast.
 - Place blasting mats over top of holes to minimize scattering of blast debris around the area.
 - Do not use ammonium nitrate based explosives in or near water due to the production of toxic by-products. Remove all blasting debris and other associated equipment/products from the blast area.
- 12.19. Per Fig. 1:20 kg total weight of charge; 25 msecs delay between charges and blast holes and decking of charges within holes. (Fisheries and Oceans Canada, 2015)

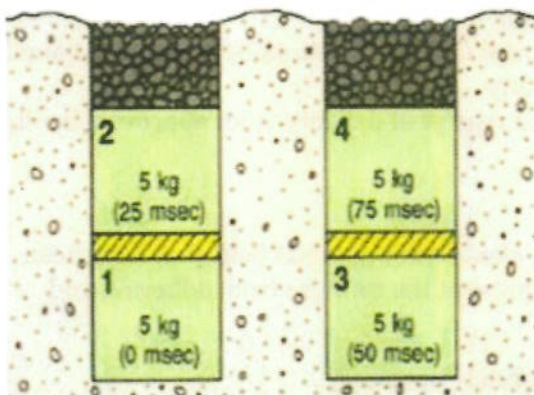


Figure 1 Sample Blasting Arrangement

13. 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

- 13.1. Asphalt works are preferably undertaken during periods of dry weather as this allows easier control of contaminated runoff and sediment.
- 13.2. 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

- 13.3. Where possible within engineering constraints, asphalt materials should be recycled to reduce the need for new gravel.
- 13.4. 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.
- 13.5. Gravel will not be crushed within 30 meters of any water body.
- 13.6. If water for cleaning is extracted from a watercourse, refer to [water withdrawal section](#) of this BMP.
- 13.7. If gravel requires washing, the water used will not be returned directly to any watercourse.
- 13.8. 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.

- 13.9. Contaminated water must be treated to meet CCME guidelines or transported outside of WLNP for disposal at an approved facility.
- 13.10. 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.

- 13.11. Truck boxes may be oiled only when absolutely necessary.
- 13.12. 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.
- 13.13. Vehicle covers shall be securely fastened.

Disposal and Clean Up of Other Waste Products

- 13.14. To ensure regular clean-up of waste asphalt and petroleum spills, a defined clean up schedule will be established during the preconstruction meeting.
- 13.15. 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.
- 13.16. 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.

14. 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

- 14.1. Temporary concrete washout facilities shall be located a minimum of 100 m from storm drain inlets, open drainage facilities, and watercourses.
- 14.2. 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.
- 14.3. Wood stakes, and sandbag materials can be used to construct temporary containment walls or "barriers".
- 14.4. 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.



- 14.5. The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.
- 14.6. Washout of concrete mixer trucks is not permitted in WLNP.
- 14.7. Wash concrete from mixer truck chutes/pumps into approved concrete washout facility or collect in an impermeable bag for disposal.
- 14.8. Pump excess concrete in concrete pump bin back into concrete mixer truck.
- 14.9. Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed offsite.
- 14.10. 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

- 14.11. 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.
- 14.12. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.
- 14.13. Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- 14.14. Temporary concrete washout facilities shall be inspected for damage (i.e. tears in PVC liner, missing sand bags, etc.).
- 14.15. 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

- 14.16. Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and restored.

Onsite Concrete Management

- 14.17. 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.
- 14.18. Water contaminated in the placing of cement and curing of concrete shall be contained and removed from the site to an approved disposal facility.
- 14.19. The concrete batching plant must be operated pursuant to applicable dust, air emission, and water quality control regulations.
- 14.20. 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.

15. 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

- 15.1. Works are preferably undertaken during periods of dry weather (e.g., summer) as this allows easier control of contaminated runoff and sediment.
- 15.2. 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

- 15.3. 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.
- 15.4. 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.
- 15.5. 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.
- 15.6. Retain a 30 metre vegetated buffer around water bodies or install runoff management structures.
- 15.7. 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.
- 15.8. Ensure gravel or road bed material is free of weeds and comes from an approved operational gravel source free of other contaminants.

Paving and Resurfacing

- 15.9. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface waters.
- 15.10. 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.
- 15.11. For asphalt handling and management see the [Asphalt Mitigation Module](#) of the BMP.

Pavement Marking and Barrier and Guardrail Reinstatement

- 15.12. 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.

- 15.13. 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.

16. Drainage Structures Mitigations Module

17. 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

- 17.1. 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.
- 17.2. 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.
- 17.3. 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.
- 17.4. 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

- 17.5. 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.
- 17.6. 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.



- 17.7. 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.
- 17.8. 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.
- 17.9. 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.
- 17.10. 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.
- 17.11. 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.
- 17.12. Hydrovac or vacuum trucks may be an option to assist in containment of wash water.
- 17.13. If water for cleaning is extracted from a watercourse, refer to [water withdrawal section](#) of this BMP.

Repairs Using Treated Wood Products

- 17.14. 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](#).
- 17.15. 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.
- 17.16. Wood preservatives should be applied in a contained area and not be applied over or within 200m of water.

Bridge and Structure Painting

- 17.17. 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.
- 17.18. 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.
- 17.19. 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.
- 17.20. Use hydro blasting or manual techniques, where possible, when removing road dirt, soluble salts and loose paint to minimize impacts to the watercourse.



- 17.21. Use water without cleaning agent additives if grease film removal is necessary.
- 17.22. Avoid use of toxic liquid paints, primers, solvents, degreasers and rust inhibitors.
- 17.23. Minimize spill potential by storing, mixing and transferring paints and solvents on land.

18. 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

- 18.1. All water withdrawal requires a Restricted Activity Permit issued by the IAO.

Equipment Cleaning

- 18.2. 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](#)).
- 18.3. Do not bring equipment into WLNP from areas that have known infestations of aquatic invasives (e.g., USA, east of Saskatchewan).
- 18.4. Thoroughly clean water trucks, hoses, pumps and intake hoses using clean HOT WATER with as much pressure as possible.
- 18.5. 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

- 18.6. 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.
- 18.7. Do not withdraw water from waterbodies that support breeding amphibians.

Water Withdrawal

- 18.8. 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.
- 18.9. 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).
- 18.10. No permanent or semi-permanent works for water withdrawal should be placed in the stream channel.
- 18.11. 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

18.12. 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

- 18.13. 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.
- 18.14. Site specific mitigations may be required depending on the conditions of the discharge area, freezing conditions operation, overflow avoidance, decanting and settlement pond restoration.
- 18.15. Water containing suspended materials shall not be pumped into watercourses, drainage systems or on to land, except with the permission of the SO.
- 18.16. Soil and vegetation erosion protection is required for water pumped on to land.

19. Buildings & Structures

20. Geotechnical

Refer to the [National Best Management Practices for Geotechnical Investigations.](#)

- 20.1. The contractor for geotechnical investigations must obtain a Restricted Activity Permit from the IAO prior to the commencement of work.
- 20.2. Prior to work in the Park, arrange environmental briefing and equipment inspection with the SO. Work vehicles and equipment will arrive in WLNP clean of organic material.



21. Service Line HDD

- 21.1. For directional drilling operations, a drilling plan will be developed by the contractor, addressing mud systems and handling, and contingency measures for circulation losses or dewatering of excavations.
- 21.2. Excavation in sensitive features to recover equipment is not permitted.
- 21.3. All mud containment structures must be situated outside of sensitive features.
- 21.4. All drill mud must be disposed of appropriately off site.
- 21.5. Use of methanol or ethylene glycol is not permitted. Propylene glycol may be permitted with review of the drill operation and drill plan by the SO. Consistent with spill plan requirements, all containers must have original labels.
- 21.6. Schedule drilling operations outside repeated days of cold weather (below -20°C).
- 21.7. Drill mud containment and frac-out response materials and equipment must be immediately available on site during operations (e.g., vacuum truck, sandbags, shovels, spill response equipment). Drill mud containment (e.g., sandbag berm) around the drill stem will be in place prior to project activities.
- 21.8. Drill mud must not contaminate topsoil. If necessary, topsoil should be removed from drill entry and restored at the end of project activities. Where possible, position equipment on existing disturbed areas.
- 21.9. A vacuum truck must be immediately available on site during all service line HDD operations within WLNP.
- 21.10. The Prime Contractor will monitor, by visual and electronic means:
 - Regular and scheduled visual checks for frac-outs (i.e. frac walks). The SO shall be notified immediately of any frac-out;
 - The return flow of drilling fluid from the borehole. A reduction in return flow shall be taken as indicating a possible seepage of drilling fluid;
 - The tank and pit volumes;
 - Any unplanned losses or gains.
- 21.11. The above monitoring techniques will assist in the detection of any potential environmental concerns and / or frac-outs during drilling activities. At the first indication of any concerns, the following is to occur:
 - Stop drilling operations and shut of the drilling fluid pumps;
 - Conduct a survey of the ground and surface water body for evidence/confirmation of seepage of drilling fluid to the surface;
 - Contain any seepages;
 - Notify the SO;
 - Assemble measurement data and observations with the SO;
 - Develop and implement a recovery clean-up plan, if necessary; and
 - Develop a drill continuance plan in consultation with the SO.

22. Fire Operations

23. Helicopter Operations

- 23.1. Safety is the primary objective during all helicopter operations.



- 23.2. All helicopter activity requires a Restricted Activity Permit from the IAO prior to commencement of work.
- 23.3. Helicopter fueling is permitted only at the fueling station of the Operations Compound.
- 23.4. All fuel drums require secondary containment during storage.
- 23.5. The Prime Contractor is responsible for ensuring that a Spill Response Plan for fuelling and fuel drum storage is developed prior to start of work, as stated in the Emergency Response Plan Module.
- 23.6. Helicopter operations must not occur within areas of exposed soils where rotor wash will disturb soils or vegetation.
- 23.7. Helicopter operations are not to occur within 100 m of sighted wildlife, raptor nests or any sensitive features, as designated in the Sensitive Features Table.



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<http://www.fao.org/docrep/w8297e/w8297e00.htm>



Appendix 1 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 2 Waterton Townsite Tree Protection and Succession Implementation Plan

The following Implementation Guideline has been created to function as a standalone document from the Waterton Townsite Grounds Vegetation Plan with content derived from the Waterton Townsite Grounds Vegetation Plan. This Appendix will function as a general guideline for proper construction practices while working in and around trees.

PROPER TREE PROTECTION PRACTICE

When constructing within approximately 6 m of an existing tree, it will be necessary to have Proper Tree Protection Practices in place. The following recommendations will assist in the prevention of unintentional tree damage.

Tree protection measures should be required for any retained public trees within the proposed limits of disturbance and within the 6 m setback from the limits of disturbance. Trees identified for retention and incorporation into the landscape plan should not be removed, damaged, or destroyed without prior written authorization from Parks Canada. Of note, the term “tree” refers to all parts of the tree including the roots.

The site specific specifications for tree protection should be outlined in the recommended Landscape Restoration Plan.

Tree Protection Measures

In order to mitigate potential damages and stress to existing publicly owned trees, tree protection measures should be in effect prior to the commencement of construction activities and should remain in effect until construction is completed. Protective barrier fencing should be installed to protect publicly owned trees located within 6 m of the limits of disturbance and for all publicly owned trees that are to be retained within the limits of disturbance. The area contained within the barrier fencing should be considered the Tree Protection Zone (TPZ).

Tree Protection Zone (TPZ)

Tree Protection Zones are limited to the Waterton Townsite and should include a 4.0 m distance from the trunk (where possible) and to a height of 1.2 m. The protective barrier fencing should be constructed of steel construction fencing or 2 x 4 wood framing skirted with fencing. The TPZ distance is to be measured from the base of the tree trunk outward beyond the drip line and Critical Root Zone (CRZ) where possible. The CRZ is the portion of tree roots requiring protection from damage in order to maintain the health and stability of a tree. One method of calculating the CRZ is that every 2.5 cm of DBH is 30 cm of CRZ radius. All supports and bracing for the protective barrier fencing should be located outside the TPZ. All supports and bracing should be placed to reduce damage to roots. The protective barrier fencing should remain standing and in good condition until construction of the project is completed. Signs identifying the TPZ should be located on the protective barrier fencing.

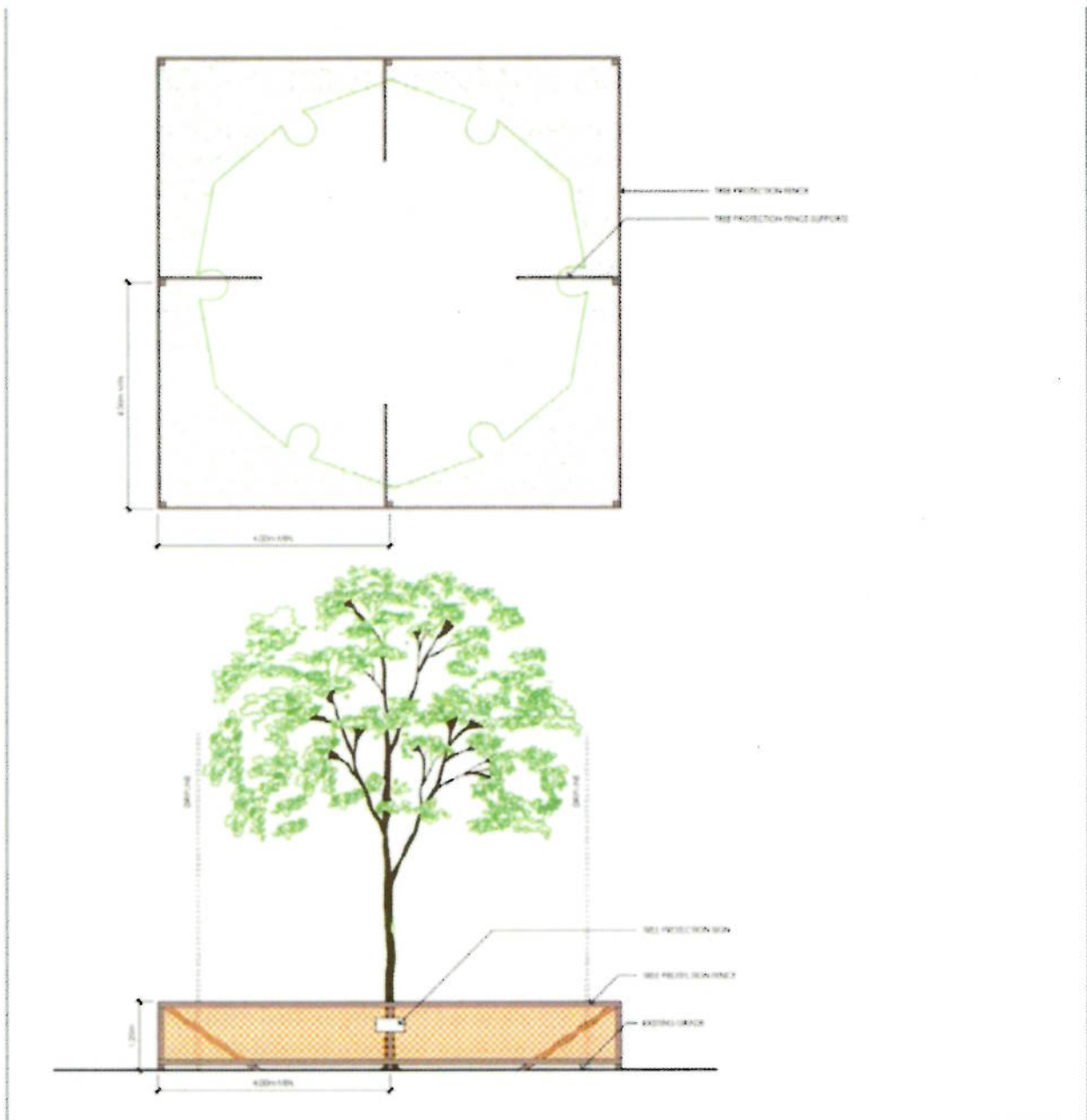


Figure 2 Construction Tree Protection Detail

Notes

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Project location:
Waterton, AB

Client/Project:
Parks Canada
Townsite Grounds Vegetation
Management Plan

Scale: 1/50
5.0
mm

Tree Protection Detail



The following should be adhered to during the construction process:

- No alteration or disturbance of the grade should occur within the TPZ;
- No equipment or construction materials should be stored within the TPZ;
- No soil, construction waste, or debris should be stored within the TPZ;
- No disposal of liquids should occur within the TPZ; and
- No vehicle, equipment, or pedestrian access through the TPZ, unless expressly permitted for the maintenance of the trees within the area.

The condition of trees within TPZs should be monitored throughout construction. A scheduled watering and monitoring program should be implemented for all trees within TPZ. Regular monitoring of the trees should occur during construction to reduce the potential that the trees are damaged by construction practices and to detect any signs of decline. Any damage or suspected damage to the trees should be rehabilitated or restored in accordance with acceptable industry standards. Trees within the TPZ should be maintained for a period of one year after construction completion. Monitoring should continue during this period to check on the continued health of the trees.

Where excavation is required within the root zone, root pruning should be completed by qualified personnel and should ensure clean cuts to facilitate wound closure. The roots should be covered with topsoil after the pruning cut has been made.

TREE REMOVAL

Throughout the Townsite, there may be trees that require removal. Reasons for tree removal may include:

- Trees restricting with desired development plan;
- Trees causing a risk or hazard post construction; and/or
- Trees causing a risk due to health and potential to cause damage.

In the event that a tree requires removal, a Succession Plan has been created to assist Landscape Architects or Designers with a planting scheme to replace the tree with appropriate vegetation.

SUCCESSION PLAN FOR TREE REPLACEMENT

The principals for the Succession Plan include replacing all non-native tree species with a 3:1 replacement ratio based on canopy cover. The replacement of trees includes using native trees of different sizes (Table 3 [H-1]). Over time, this will allow the public and green areas within the Townsite to be composed of trees of different size, age and species diversity, reflecting the natural surroundings.

The strategy recommended for this Succession Plan is to use trees of different sizes. Available sizes and appropriate tree species are outlined in Table 3 (H-1). The ratio of basket trees and potted trees was determined by estimating the amount of canopy cover needed to replace what is removed. The ratio of choosing deciduous trees or coniferous trees should be approximately 1:2 to 1:2.5 ratios as it will better emanate the surrounding landscape. The combinations of deciduous to coniferous species may vary from what is displayed in Figure H-1. The following combinations of trees should be used to guide planting for succession. Any removed trees should be replaced using the following combinations:



Appendix 2 WLNP General Project Best Management Practices Waterton Townsite Tree Protection and Succession Implementation Plan

- Combination #1 one tree removed and replaced with three basket trees of different sizes;
- Combination #2 one tree removed and replaced with two basket trees of different sizes and three potted trees of different sizes; or
- Combination #3 one tree removed and replaced with one basket tree and eight potted trees using as much variety in size as available.

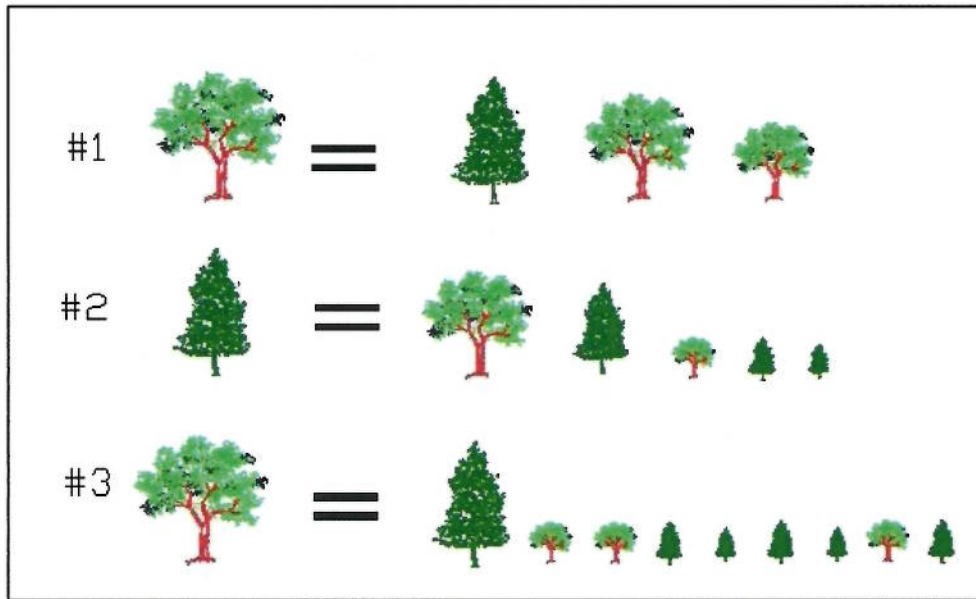


Figure 3 Three Tree Replacement Combinations

* Deciduous and coniferous species are subject to change within the above combination schemes.

Table 2 Tree Replacement Options and Sizes Available

Common Name	Scientific Name	Available size options in baskets	Available size options in pots	Fire resistant/ low palatability	Appropriate Townsite landscape zones
white spruce	<i>Picea glauca</i>	125cm, 150cm, 200cm, 250cm, 300cm, 350cm, 400cm, 450cm,	#1, #5	Low palatability	Zone 1, 2, 3
Douglas fir	<i>Pseudotsuga menziesii</i>	125cm, 150cm, 200cm, 250cm,	#1, #5	Fire resistant	Zone 1, 3
trembling aspen	<i>Populus tremuloides</i>	40mm, 50mm, 60mm, 70mm, 80mm, 90mm, 100mm	#5, #7, #10, #15	Fire resistant	Zone 1, 2, 3, 4, 5
balsam poplar	<i>Populus balsamifera</i>	50mm, 60mm, 70mm, 80mm	#7	Fire resistant and low palatability	Zone 1, 2, 3, 4, 5



Appendix 2 WLNP General Project Best Management Practices
Waterton Townsite Tree Protection and Succession Implementation Plan

Common Name	Scientific Name	Available size options in baskets	Available size options in pots	Fire resistant/ low palatability	Appropriate Townsite landscape zones
<p>NOTE:</p> <p>Zone 5 is located along Cameron Creek (in the Townsite), following the creek south to the shoreline and north along the shoreline; it then curves around the Marina stopping at the tip of Emerald Bay. When replacement planting within Zone 5 between Waterton Avenue and the shoreline special consideration for planting choices will be needed. The shoreline area has a high flooding risk requiring more flood-resistant species selection. When planting in the flood plain species such as willows and river birch should be used. An Erosion and Sediment Control Plan should also be considered before planting in these locations to ensure the long-term sustainability of the plantings.</p>					

Tree Replacement Locations

Within the Waterton Townsite there are multiple locations that are suitable for tree replacement in accordance with the Successional Plan. It is recommended to plant new trees in any green space that will sustain healthy trees. Contractors are recommended to begin planting within Lot A, B, C, D and the Waterton Campground. Below is a map that shows the locations of the Lots that will be refurbished over time (Figure 6).



Figure 4 Waterton Townsite showing lot locations for potential tree planting



Appendix 3 Trees and Shrubs Recommended for Waterton Park Townsite

The following is a condensed list of native tree and shrub species which are recommended for planting in the Waterton Townsite area. Species of trees and shrubs native to the Waterton area are the preferred species to be used when planting and should be sourced locally to prevent the introduction of non-native varieties. Where possible species have been selected to minimize the attraction to wildlife (bears, deer, elk) and have reduced fire risk potential. Species not found on this list must be approved by the Park Ecologist (Vegetation) or representative prior to planting.

TREES

Coniferous:

Douglas fir (*Pseudotsuga menziesii*) – medium browse; medium fire

- Growing to 10 metres or more with a massive trunk and dense, spreading branches. Occurs at low elevations on dry exposed slopes and ridges.
- A primary species on disturbed sites, it occupies a variety of habitats from moist to very dry soils
- Adaptable to most sites; therefore good survival rate
- Good windthrow resistance; good shade tree
- Plant well away from eaves troughs (high needle cast)

White Spruce (*Picea glauca*) – Low browse; high fire

- Often somewhat bluish-green with a dense crown, up to 15 metres in height.
- Best on a moist site; needs a great deal of water, especially after transplanting
- Good shade tree; wind and shade tolerant.
- Colorado Spruce is not a desirable alternative; it's non-native

Lodgepole Pine (*Pinus contorta*) – low browse; high fire

- Occurs on a wide variety of soils, at low to middle elevations
- Young trees are intolerant of shade and grow best on dry exposed sites

Deciduous:

Trembling aspen (*Populus tremuloides*) – high browse; very low fire

- Rather small and more or less rounded leaves
- Mature trees form groves from root suckers.
- Require a moderately moist site
- NOTE – lots of hybrid and cultivar species available – these must not be used.

Balsam Poplar (*Populus balsamifera*) – high browse; very low fire

- Tall tree growing best along creek-beds and lakeshores (requires a moist site)
- Long, wide leaf-blades
- Sticky seed scales can be a nuisance; roots can surface

Paper Birch (*Betula papyrifera*) – low browse; very low fire



WLNP General Project Best Management Practices
Appendix 3 Trees and Shrubs Recommended for Waterton Park Townsite

- A slender, long-branched tree – 10-25 m tall, mature bark mostly white; peeling
- Moist upland sites; shade intolerant
- Can withstand moderate drought once established

Water Birch (*Betula occidentalis*) – low browse; very low fire

- Smaller tree - <10m; dark-reddish brown bark that does not peel.
- Good early successional species in moist areas

SHRUBS:

Mountain Maple (*Acer glabrum*) – medium browse; very-low fire

- A red-stemmed shrub growing to a few metres tall. Typical "maple leaf" shaped leaf blades
- Will grow on rocky sites

Shrubby Cinquefoil (*Potentilla fruticosa*) – low browse; low fire

- A coarse shrub of grasslands and open places, decorated June to September with numerous small, yellow, rose-like flowers.
- NOTE – lots of hybrid and cultivar species available – these must not be used.

Red Osier Dogwood (*Cornus stolonifera*) - high browse; low fire

- Willow-like shrub with distinct red bark and small greenish-white flowers; 1 to 3 metres tall
- grows best in damp, somewhat sheltered places

Wolf Willow (*Elaeagnus commutata*) – medium browse; low fire

- Leaves silvery in colour; exhibits small yellow aromatic flowers in June/July
- Forms small groves in seepage areas
- NOTE – lots of hybrid and cultivar species available – these must not be used.

Snowberry (*Symphoricarpos albus*) – medium browse; low fire

- Common in a variety of habitats
- Small bell-shaped flowers June to August

Buffalo-berry (*Shepherdia canadensis*) – medium browse; low fire

- PLANT MALE SHRUBS ONLY
- Spreading shrub to 3m tall

Common Wild Rose (*Rosa woodsii*) – medium browse; low fire

- Exhibits bright pink flowers in June and July
- Open woods and thickets, some tolerance to sandy areas

Prickly Rose (*Rosa acicularis*) – high browse; low fire

- Branching shrub, up to 1.5 metres high
- Open woods and moist thickets

Tree Standards:



Appendix 3 WLNP General Project Best Management Practices Trees and Shrubs Recommended for Waterton Park Townsite

- In cases of tree replacement, the three replacement trees should be as large as available, with a 15 gallon root size and at least ¾" trunk size. If 15 gallon native trees are not available, on approval of the Parks Canada Surveillance Officer (SO), four 10 gallon trees may be planted instead.
- All trees must be guaranteed for one year (one growing season).
- Trees shall be inspected immediately after initial planting and during the growing season by a designated Parks Canada SO. After the growing season, the SO will determine final acceptance of the tree.
- Any planted tree that is dead or, in the opinion of the SO, is in an unhealthy or unsightly condition, and/or has lost its natural shape due to dead branches, excessive pruning, inadequate or improper maintenance, or other causes prior to final acceptance, shall be replaced in the next planting season. There shall be a growing season guarantee on trees commencing after the final inspection of the permitted planting.
- 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.

General Tips:

- Select the right tree for the site. It is important to match your planting site and its conditions with a tree species' shade, moisture, and soil preferences.
- Plants should be put in the ground in autumn or spring and fenced immediately to prevent animal damage.
- Frequent watering is necessary for the weeks following transplantation or first growing season, and if possible up to the first frost.
- It is advisable to screen young plants from wind over the winter.
- Avoid planting dense clusters of shrubs; this helps limit cover for large animals such as cougars and reduces fire hazards.
- Even "fire resistant" vegetation will burn if the plant's moisture content is low.
- To prevent the spread of non-native species and reduce the appeal of the townsite for animals such as deer and bear, please avoid planting the following:
 - Saskatoon (*Amelanchier alnifolia*) - berries attract bears
 - Chokecherry (*Prunus virginiana*) - cherries can attract bears
 - Pincherry (*Prunus pennsylvanica*) - cherries can attract bears



Appendix 4 List of Non-Native Species of Local Concern

Contact the Impact Assessment Office for more information about potential site specific non-native species of concern.

Table 3 Non-native Species Listed by the Alberta Weed Control Act

Common Name	Scientific Name
Prohibited Noxious	
autumn olive	<i>Elaeagnus umbellata</i> Thunb.
balsam, Himalayan	<i>Impatiens glandulifera</i> Royle
barberry, common	<i>Berberis vulgaris</i> L.
bartsia, red	<i>Odonites vernus</i> (Bellardi) Dumort
buckthorn, common	<i>Rhamnus cathartica</i> L.
cinquefoil, sulphur	<i>Potentilla recta</i> L.
crupina, common	<i>Crupina vulgaris</i> Pers. ex Cass.
dyer's woad	<i>Isatis tinctoria</i> L.
Eurasian water milfoil	<i>Myriophyllum spicatum</i> L.
flowering rush	<i>Butomus umbellatus</i> L.
garlic mustard	<i>Alliaria petiolata</i> (M. Bieb.) Cavara & Grande
goatgrass, jointed	<i>Aegilops cylindrica</i> Host
hawkweed, meadow	<i>Hieracium caespitosum</i> Dumort.
hawkweed, mouse-ear	<i>Hieracium pilosella</i> L.
hawkweed, orange	<i>Hieracium aurantiacum</i> L.
hoary alyssum	<i>Berteroa incana</i> (L.) DC.
hogweed, giant	<i>Heracleum mantegazzianum</i> Sommier & Levier
iris, pale yellow	<i>Iris pseudacorus</i> L.
knapweed, bighead	<i>Centaurea macrocephala</i> Puschk. ex Willd.
knapweed, black	<i>Centaurea nigra</i> L.
knapweed, brown	<i>Centaurea jacea</i> L.
knapweed, diffuse	<i>Centaurea diffusa</i> Lam.
knapweed, hybrid	<i>Centaurea × psammogena</i> Gayer
knapweed, meadow	<i>Centaurea × moncktonii</i> C. E. Britton
knapweed, Russian	<i>Rhaponticum repens</i> (L.) Hidalgo
knapweed, spotted	<i>Centaurea stoebe</i> L. ssp. <i>Micranthos</i> (Gugler) Hayek
knapweed, squarrose	<i>Centaurea virgata</i> Lam. ssp. <i>squarrosa</i> (Willd.) Gugler
knotweed, giant	<i>Fallopia sachalinensis</i> (F. Schmidt Petrop.) Ronse Decr.
knotweed, hybrid Japanese	<i>Fallopia × bohémica</i> (Chrtek & Chrtková) J. P. Bailey
knotweed, Japanese	<i>Fallopia japonica</i> (Houtt.) Ronse Decr.
loosestrife, purple	<i>Lythrum salicaria</i> L.
medusahead	<i>Taeniatherum caput-medusae</i> (L.) Nevski
nutsedge, yellow	<i>Cyperus esculentus</i> L.
puncturevine	<i>Tribulus terrestris</i> L.
ragwort, tansy	<i>Jacobaea vulgaris</i> Gaertn.
rush skeletonweed	<i>Chondrilla juncea</i> L.
saltcedar	<i>Tamarix ramosissima</i> Ledeb.
saltlover	<i>Halogeton glomeratus</i> (M. Bieb.) C.A. Mey.
St John's-wort, common	<i>Hypericum perforatum</i> L.
starthistle, yellow	<i>Centaurea solstitialis</i> L.
tamarisk, Chinese	<i>Tamarix chinensis</i> Lour.
tamarisk, smallflower	<i>Tamarix parviflora</i> DC.



WLNP General Project Best Management Practices
Appendix 4 List of Non-Native Species of Local Concern

Common Name	Scientific Name
thistle, marsh	<i>Cirsium palustre</i> (L.) Scop.
thistle, nodding	<i>Carduus nutans</i> L.
thistle, plumeless	<i>Carduus acanthoides</i> L.
Noxious	
baby's-breath, common	<i>Gypsophila paniculata</i> L.
bellflower, creeping	<i>Campanula rapunculoides</i> L.
bindweed, field	<i>Convolvulus arvensis</i> L.
blueweed	<i>Echium vulgare</i> L.
brome, downy	<i>Bromus tectorum</i> L.
brome, Japanese	<i>Bromus japonicus</i> Thunb.
burdock, great	<i>Arctium lappa</i> L.
burdock, lesser	<i>Arctium minus</i> (Hill) Bernh.
burdock, woolly	<i>Arctium tomentosum</i> Mill.
buttercup, tall	<i>Ranunculus acris</i> L.
chamomile, scentless	<i>Tripleurospermum inodorum</i> (L.) Sch. Bip.
clematis, yellow	<i>Clematis tangutica</i> (Maxim.) Korsh.
cockle, white	<i>Silene latifolia</i> Poir. ssp. <i>alba</i> (Miller) Greuter & Burdet
daisy, oxeye	<i>Leucanthemum vulgare</i> Lam.
dame's rocket	<i>Hesperis matronalis</i> L.
henbane, black	<i>Hyoscyamus niger</i> L.
hoary cress, globe-podded	<i>Lepidium appelianum</i> Al-Shehbaz
hoary cress, heart-podded	<i>Lepidium draba</i> L.
hoary cress, lens-podded	<i>Lepidium chalepense</i> L.
hound's-tongue	<i>Cynoglossum officinale</i> L.
mullein, common	<i>Verbascum thapsus</i> L.
pepper-grass, broad-leaved	<i>Lepidium latifolium</i> L.
scabious, field	<i>Knautia arvensis</i> (L.) Coult.
sow thistle, perennial	<i>Sonchus arvensis</i> L.
spurge, leafy	<i>Euphorbia esula</i> L.
tansy, common	<i>Tanacetum vulgare</i> L.
thistle, Canada	<i>Cirsium arvense</i> (L.) Scop.
toadflax, Dalmatian	<i>Linaria dalmatica</i> (L.) Mill.
toadflax, yellow	<i>Linaria vulgaris</i> Mill.

Table 4 List of non-native species of local concern considered invasive in natural habitats.

Common Name	Scientific Name



Appendix 5 Lighting / Dark Sky Compliance Guidelines

Outdoor lighting is required for a variety of reasons, including safety and visitor experience. Best Practices are that any required lighting be used wisely. To minimize the harmful effects of light pollution, the [International Dark-Sky Association](http://www.darksky.org) (IDA) promotes that lighting should:

- Only be on when needed,
- Only light the area that needs it,
- Be no brighter than necessary,
- Minimize blue light emissions,
- Be fully shielded (pointing downward).

The IDA provides an easy visual guide to understand the differences between unacceptable, unshielded light fixtures and those fully shielded fixtures that minimize skyglow, glare and light trespass. Additional information on types of light, colour temperature, and sourcing compliant lights is available on the IDA website darksky.org.

Resources to assist the IAO are available at: [G:\Electronic Bookshelf\Park Management\Dark Sky](#)

Dick, Robert. 2014. Report on Current Lighting within Waterton Lakes National Park, Specifically the Town Site of Waterton. Report presented to Parks Canada.

Dick, Robert. 2013. [Grab your reader's attention with a great quote from the document or use this space to emphasize a key point. To place this text box anywhere on the page, just drag it.]

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http://rasc.ca/sites/default/files/RASC%20DSP%20GOL%20-%20Summer%202013_0.pdf

Parks Canada. 2008. Guidelines and Specifications for Outdoor Lighting at Parks Canada, March 2008 (Revised: February 2016).

http://intranet2/media/2685129/guidelines_and_specifications_for_outdoor_lighting_2016.pdf

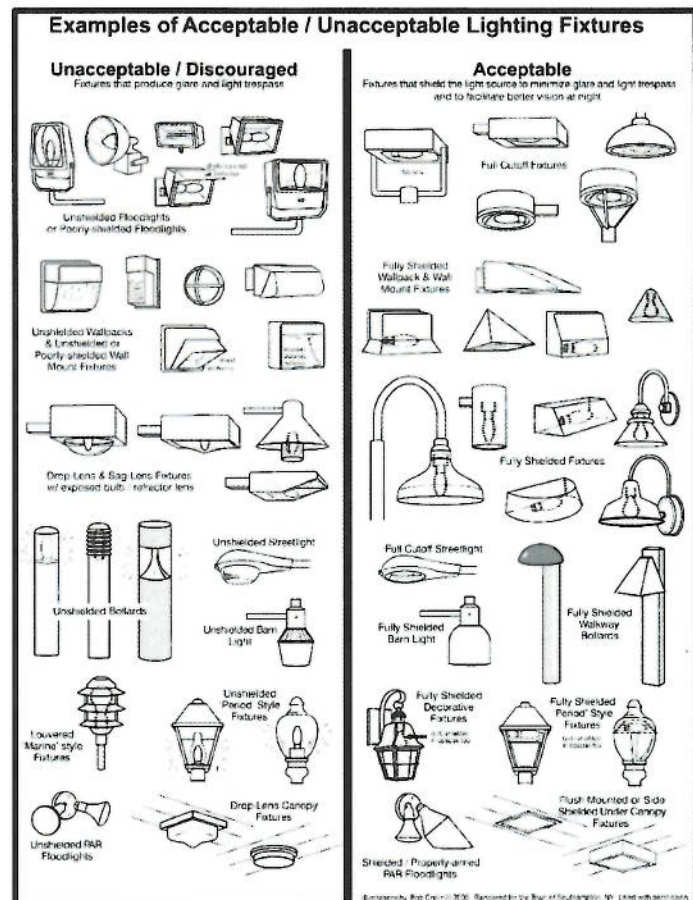


Figure 5 Examples of Acceptable / Unacceptable Lighting Fixtures.



WLNP General Project Best Management Practices

Re: Fw: Waterton Townsite Projects (FII) 

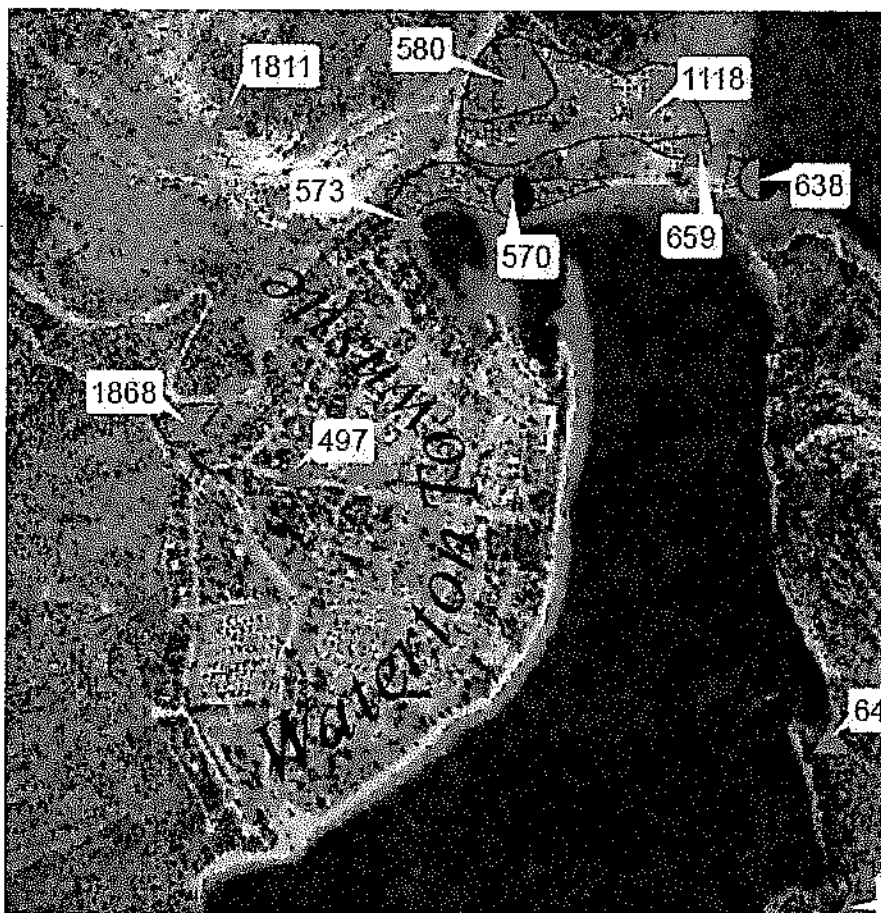
Gwyn Langemann to: Jennifer Carpenter

02/08/2016 02:07 PM

Cc: Bill Perry, Erin Rowlands, Gwenaelle Le Parlouer, Virginia Sheehan, Aaron Osicki,
Edwin Knox

Hi Jen,

Thanks for the chance to review this one. I don't think this one needs an AOA, or any advance field assessment. The accidental finds clause should cover off our concerns. As with previous utility upgrades, this project will for the most part involve areas that have already been disturbed by installation of the original utilities.



There is a possibility that isolated finds could be made, particularly in the area of 497R.

Site 497R (DgPI-121) was recorded by Reeves in 1970 as a pre-contact campsite; he had observed flakes, fire-broken rock, a point tip, and bone exposed in tree roots and driveways in the area, dispersed over lots 4, 6, 7, and 8 of Block 29, across from the the schoolyard. Reeves was told that someone had found a maul there in the past. No-one since then has observed artefacts in the area, and the presumption is that much of the site is destroyed.

Site 1868R is a bison skull find up the hill, near the reservoir, and well out of the project area.

Do please call if you have any questions,
Cheers,
Gwyn

E. Gwyn Langemann, MA
Archaeologist | Archéologue
Archaeology and History Branch | Direction de l'archéologie et de l'histoire
Indigenous Affairs and Cultural Heritage Directorate | Direction générale des affaires autochtones et du patrimoine culturel
Parks Canada | Parcs Canada
1300 - 635 - 8th Ave SW, Calgary, AB, T2P 3M3 | 1300 - 635 - 8ième avenue s.o., Calgary, AB, T2P 3M3
gwyn.langemann@pc.gc.ca
Telephone | Téléphone 403-292-4471

Government of Canada | Gouvernement du Canada
Time to Connect / Un bon temps pour se rapprocher

Jennifer Carpenter Hi Gwyn/Bill To add to the list of townsite project...

28/07/2016 11:36:05 AM

From: Jennifer Carpenter/NOTES/PC/CA
To: Gwyn Langemann/NOTES/PC/CA@PC, Bill Perry/NOTES/PC/CA@PC
Cc: Erin Rowlands/NOTES/PC/CA@PC
Date: 28/07/2016 11:36 AM
Subject: Fw: Waterton Townsite Projects (FII)

Hi Gwyn/Bill

To add to the list of townsite projects I sent you a while back, a quick heads up on the next approval we are working on.

Erin will follow up with the official CRIA request, project form etc. off to Gwenaëlle and we're seeking your advice to put on the form because we *think* this will be an easy quick townsite project with advice consistent to what you have given us below.

Thanks and take care,
-Jen

WL-16-017- Townsite Water and Sewer Phase C, D, E (these are the next phases of the townsite water and sewer project - they are in green, pink and blue on the attached PDF). This doesn't include any areas by the Superintendent's House or Emerald Bay. (The yellow was completed in 2013).

Project is currently being reviewed under our General Waterton BMP which includes the accidental finds clause.

[attachment "2016.07.27 Waterton Streetworks Environmental project description.doc" deleted by Gwyn Langemann/NOTES/PC/CA] [attachment "R.075721.001 - WLNP - Phase C D E phasing 1 REV.B.pdf" deleted by Gwyn Langemann/NOTES/PC/CA]



July 25, 2016

Amec Foster Wheeler File: LT164504.100

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 Infrastructure Renewal
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 throughout the northern portion of the Waterton Townsite.

This report summarizes the results of the field work and laboratory testing, and provides geotechnical discussion and recommendations to support the proposed project. This report has been revised to also include proposed storm sewer construction along the rear lane west of Evergreen Avenue.

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 March 24, 2016 and monitored the drilling of seven boreholes. An additional seven boreholes were advanced at the site on July 14, 2016. The boreholes were drilled at the locations denoted on Figure 1 as BH16-01 to BH16-14, inclusive, at the following general locations.

- BH16-01 was drilled along Mountain View Road just west of Wind Flower Avenue;
- BH16-02 to BH16-04 were drilled along Cameron Falls Drive between Fountain Avenue and Wind Flower Avenue;
- BH16-05 was drilled along Clematis Avenue just east of Lupine Lane;
- BH16-06 was drilled along Harebell Road, just north of Lupine Lane;



- BH16-07 was drilled between Harebell Road and Wind Flower Avenue and North of Vimy Avenue; and
- BH16-08 to BH16-14 were drilled along the rear lane west of Evergreen Avenue.

The boreholes were advanced using a truck-mounted drill equipped with continuous flight solid stem augers operated by Chilako Drilling Services, and were terminated at depths ranging between of about 2.6 m and 3 m below existing grade. During the drilling, representative samples of the subsurface strata were recovered from the auger flights. Upon completion of the drilling, the boreholes were backfilled with the auger cuttings.

The drilling was 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 appended borehole logs.

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 borehole logs and summarized in the following paragraphs.

Boreholes BH16-01 to BH16-07

Topsoil

With the exception of borehole BH16-04, the boreholes were each surfaced with layer of topsoil ranging between about 0.1 m to 0.15 m thick.

Crushed Gravel

Borehole BH16-04 was surface with a 0.2 m thick layer of crushed gravel.

Sand & Gravel

The predominant natural mineral soil encountered in each of the borehole was sand and gravel. The sand and gravel was described as fine grained and silty with occasional cobbles, brown, and compact (based on tactile observations and observed drilling resistance).

Based on laboratory testing, the *in situ* water content of the sand and gravel ranged between about 3 percent and 5.5 percent, generally indicative of moist to very moist soil conditions.



Boreholes BH16-08 to BH16-14

The boreholes along the rear lane west of Evergreen Avenue were each surface with a layer of asphalt, underlain by low plastic clay described as silty, sandy and gravelly. The clay was generally in a firm and moist condition, and extended to depths ranging between about 1.2 m and 3.0 m below the roadway surface. At boreholes BH16-09 to BH16-14, a layer of sand and gravel was encountered underlying the upper clay soils. The sand and gravel was described as medium to coarse grained, clayey, and moist to very moist.

Sloughing and Groundwater Conditions

The boreholes were each dry upon completion of the drilling. 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 throughout the northern portion of the Waterton Townsite, as well as storm sewer construction along the rear lane west of Evergreen Avenue. It is anticipated that the installation of underground utility pipe will generally be by conventional open cut techniques.

In general, the existing soil and groundwater conditions along the subject streets will support conventional open cut construction for the proposed pipe installation, followed by conventional roadway reconstruction.

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, γ , kN/m ³	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. However, groundwater in the Waterton Townsite is known to fluctuate rather dramatically throughout the year and as a result of the level of water in the adjacent Upper Waterton Lake.

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, would likely be required where excavation below the groundwater table is required. Amec can assist further in this regard, upon request.

3.2 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.

3.3 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 * The reclaimed asphalt (millings) should be well graded with a maximum size of 25 mm. 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 14 boreholes drilled 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.

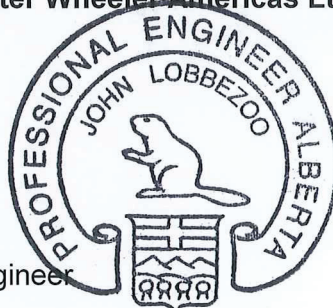
Amec Foster Wheeler requests the opportunity to review the design drawings and the installation of the foundations to confirm that the recommendations in this report have been correctly interpreted and implemented. If not afforded the opportunity to conduct this review, Amec Foster Wheeler will not accept 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.


John Lobbezoo, P.Eng.
Geotechnical Project Engineer




Co-Authored by:
Mohamadjavad Sheikhtaheri, M.A.Sc
Geotechnical EIT

Reviewed by:
Kevin Spencer, P.Eng.
Associate Geotechnical Engineer

Attachments: Figure 1: Borehole Location Plan
Borehole Logs
Explanation of Symbols and Terms

APEGA PERMIT P04546



Amec Foster Wheeler Environment & Infrastructure 469 - 40th Street South Lethbridge, Alberta CANADA T1J 4M1 Tel. (403) 327-7474 Fax (403) 327-7682		amec foster wheeler 		Public Works and Government Services Canada		
TITLE		BOREHOLE LOCATION PLAN		DWN BY: BJ	DATUM: NA	DATE: JULY 2016
PROJECT		Waterton Townsite Streetworks PHASE C Waterton Lakes National Park, Alberta		CHK'D BY: JS	PROJECT NO: LT164504.100	FIGURE 1
				SCALE: NTS		

BHLOGS.GPJ 16/04/27 04:36 PM (BOREHOLE LOG)

PROJECT: Waterton Townsite Infrastructure Renewal		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-01	
CLIENT: Public Works and Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT154508.800	
LOCATION: Mountain View Rd W of Wind Flower (refer to Figure 1)				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)	<div style="text-align: center;"> </div>	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			TOPSOIL					0
1			GRAVELLY SAND - fine grained, coarse grained gravel, silty, sandy, moist			1S1		1
2								2
3								3
4			End of Borehole at 3.0 m depth Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT154508.800. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					4
5								5
6								6
7								7
8								8
9								9
10								10

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MG	COMPLETION DEPTH: 3.00 m
	REVIEWED BY: JL	COMPLETION DATE: 24/3/16
	Page 1 of 1	

BHLOGS.GPJ 16/04/27 04:36 PM (BOREHOLE LOG)

PROJECT: Waterton Townsite Infrastructure Renewal		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-02	
CLIENT: Public Works and Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT154508.800	
LOCATION: Cameron Falls Dr between Fountain & Wind Flower (refer to Figure 1)				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)	<div style="text-align: center;"> STANDARD PEN (N) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80 </div>	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			TOPSOIL					0
			GRAVELLY SAND - fine grained, coarse grained gravel, silty, sandy, moist			1S1		1
1								1
2								2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10
			End of Borehole at 2.6 m depth Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT154508.800. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MG	COMPLETION DEPTH: 2.60 m
	REVIEWED BY: JL	COMPLETION DATE: 24/3/16
	Page 1 of 1	

PROJECT: Waterton Townsite Infrastructure Renewal		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-03	
CLIENT: Public Works and Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT154508.800	
LOCATION: Cameron Falls Dr between Fountain & Wind Flower (refer to Figure 1)				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> SPT Test (N)	<input type="checkbox"/> Grab Sample
BACKFILL TYPE		<input type="checkbox"/> Bentonite	<input type="checkbox"/> Pea Gravel	<input type="checkbox"/> Slough	<input type="checkbox"/> Grout
				<input checked="" type="checkbox"/> Split-Pen	<input type="checkbox"/> Core
				<input checked="" type="checkbox"/> Drill Cuttings	<input type="checkbox"/> Sand

Depth (m)	<div> <div> <div>STANDARD PEN (N)</div> <div>20 40 60 80</div> </div> <div> <div>PLASTIC M.C. LIQUID</div> <div>20 40 60 80</div> </div> </div>	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			TOPSOIL					0
0.5	●		GRAVELLY SAND - fine grained, coarse grained gravel, silty, sandy, moist		3S1			0.5
3.0			End of Borehole at 3.0 m depth					3.0
4.0			Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT154508.800. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					4.0
5.0								5.0
6.0								6.0
7.0								7.0
8.0								8.0
9.0								9.0
10.0								10.0

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MG	COMPLETION DEPTH: 3.00 m
	REVIEWED BY: JL	COMPLETION DATE: 24/3/16
	Page 1 of 1	

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PROJECT: Waterton Townsite Infrastructure Renewal		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-04	
CLIENT: Public Works and Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT154508.800	
LOCATION: Cameron Falls Dr between Fountain & Wind Flower (refer to Figure 1)				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)	<div style="text-align: center;"> STANDARD PEN (N) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80 </div>	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0		▲▲▲	CRUSHED GRAVEL GRAVELLY SAND - fine grained, coarse grained gravel, silty, sandy, moist					0
1		▲▲▲				2S1		1
2		▲▲▲	End of Borehole at 2.0 m depth Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT154508.800. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MG	COMPLETION DEPTH: 2.00 m
	REVIEWED BY: JL	COMPLETION DATE: 24/3/16
	Page 1 of 1	

PROJECT: Waterton Townsite Infrastructure Renewal		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-05	
CLIENT: Public Works and Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT154508.800	
LOCATION: Clematis Ave W of Lupine (refer to Figure 1)				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> SPT Test (N)	<input type="checkbox"/> Grab Sample
BACKFILL TYPE		<input type="checkbox"/> Bentonite	<input type="checkbox"/> Pea Gravel	<input type="checkbox"/> Slough	<input type="checkbox"/> Grout
				<input checked="" type="checkbox"/> Split-Pen	<input type="checkbox"/> Core
				<input checked="" type="checkbox"/> Drill Cuttings	<input type="checkbox"/> Sand

Depth (m)	<div> <div> <div>STANDARD PEN (N)</div> <div>20 40 60 80</div> </div> <div> <div>PLASTIC M.C. LIQUID</div> <div>20 40 60 80</div> </div> </div>	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			TOPSOIL GRAVELLY SAND - fine grained, coarse grained gravel, silty, sandy, moist					0
1					1S1			1
2								2
3								3
4			End of Borehole at 3.0 m depth Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT154508.800. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					4
5								5
6								6
7								7
8								8
9								9
10								10

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MG	COMPLETION DEPTH: 3.00 m
	REVIEWED BY: JL	COMPLETION DATE: 24/3/16
	Page 1 of 1	

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PROJECT: Waterton Townsite Infrastructure Renewal		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-06	
CLIENT: Public Works and Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT154508.800	
LOCATION: Harebell Rd N of Lupine (refer to Figure 1)				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input checked="" type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input checked="" type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)	<div> <div> <div>STANDARD PEN (N)</div> <div>20 40 60 80</div> </div> <div> <div>PLASTIC M.C. LIQUID</div> <div>20 40 60 80</div> </div> </div>	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			TOPSOIL					0
0.5	●		GRAVELLY SAND - fine grained, coarse grained gravel, silty, sandy, moist		1S1			0.5
2.4			... occasional cobbles below 2.4 m depth					2.4
2.7		End of Borehole at 2.7 m depth						2.7
3		Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT154508.800. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.						3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MG	COMPLETION DEPTH: 2.70 m
	REVIEWED BY: JL	COMPLETION DATE: 24/3/16
	Page 1 of 1	

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PROJECT: Waterton Townsite Infrastructure Renewal		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-07	
CLIENT: Public Works and Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT154508.800	
LOCATION: Between Harebell & Wind Flower, N of Vimy (refer to Figure 1)				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)	<div style="text-align: center;"> STANDARD PEN (N) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80 </div>	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			TOPSOIL					0
			GRAVELLY SAND - fine grained, coarse grained gravel, silty, sandy, moist			1S1		1
1								1
2								2
3			End of Borehole at 2.8 m depth					3
4			Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT154508.800. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					4
5								5
6								6
7								7
8								8
9								9
10								10

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MG	COMPLETION DEPTH: 2.80 m
	REVIEWED BY: JL	COMPLETION DATE: 24/3/16
	Page 1 of 1	

PROJECT: Waterton Townsite Street Works		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-08	
CLIENT: Public Works & Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT164504.100	
LOCATION: Rear lane west of Evergreen Avenue; Refer to Figure 1				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)		SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			ASPHALT					
			CLAY - low plastic, silty, sandy, gravelly, brown, firm, moist to very moist					
			... medium to coarse grained gravel increased below 0.7 m depth			S1		
1						S2		1
						S3		
2						S4		2
						S5		
3						S6		3
			End of Borehole at 3 m depth					
			Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT164504.100. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole was open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					
4								4
5								5

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MS	COMPLETION DEPTH: 3.00 m
	REVIEWED BY: JL	COMPLETION DATE: 14/7/16
	Page 1 of 1	

BHLOGS.GPJ 16/07/25 10:27 AM (BOREHOLE LOG)

PROJECT: Waterton Townsite Street Works		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-09	
CLIENT: Public Works & Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT164504.100	
LOCATION: Rear lane west of Evergreen Avenue; Refer to Figure 1				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)		SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			ASPHALT					
			CLAY - low plastic, silty, sandy, gravelly, brown, firm, moist to very moist ... medium to coarse grained gravel increased below 0.6 m depth			S1		
1						S2		
						S3		
2			GRAVEL - medium to coarse grained, clayey, moist			S4		
						S5		
3						S6		
4			End of Borehole at 3.8 m depth Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT164504.100. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole was open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					
5								

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MS	COMPLETION DEPTH: 3.80 m
	REVIEWED BY: JL	COMPLETION DATE: 14/7/16
	Page 1 of 1	

BHLOGS.GPJ 16/07/25 10:27 AM (BOREHOLE LOG)

PROJECT: Waterton Townsite Street Works		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-10	
CLIENT: Public Works & Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT164504.100	
LOCATION: Rear lane west of Evergreen Avenue; Refer to Figure 1				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input checked="" type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input checked="" type="checkbox"/> Grab Sample <input checked="" type="checkbox"/> Split-Pen <input checked="" type="checkbox"/> Core			
BACKFILL TYPE		<input checked="" type="checkbox"/> Bentonite <input checked="" type="checkbox"/> Pea Gravel <input checked="" type="checkbox"/> Slough <input checked="" type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input checked="" type="checkbox"/> Sand			

Depth (m)		SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			ASPHALT					
			CLAY - low plastic, silty, sandy, gravelly, brown, firm, moist					
			... medium to coarse grained gravel increased below 0.8 m depth					
1						S1		1
						S2		
						S3		
2			GRAVEL - meduim to coarse grained, clayey, moist			S4		2
						S5		
3						S6		3
4								4
5								5

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MS	COMPLETION DEPTH: 3.30 m
	REVIEWED BY: JL	COMPLETION DATE: 14/7/16
	Page 1 of 1	

BHLOGS.GPJ 16/07/25 10:27 AM (BOREHOLE LOG)

PROJECT: Waterton Townsite Street Works		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-11	
CLIENT: Public Works & Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT164504.100	
LOCATION: Rear lane west of Evergreen Avenue; Refer to Figure 1				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)		SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			ASPHALT					
			CLAY - low plastic, silty, sandy, gravelly, brown, firm, moist					
			... medium to coarse grained gravel increased below 0.7 m depth			S1		
1						S2		1
			GRAVEL - medium to coarse grained, clayey, moist to very moist			S3		
2						S4		2
						S5		
3						S6		3
			End of Borehole at 3 m depth					
			Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT164504.100. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole was open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					
4								4
5								5

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MS	COMPLETION DEPTH: 3.00 m
	REVIEWED BY: JL	COMPLETION DATE: 14/7/16
	Page 1 of 1	

BHLOGS.GPJ 16/07/25 10:27 AM (BOREHOLE LOG)

PROJECT: Waterton Townsite Street Works		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-12	
CLIENT: Public Works & Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT164504.100	
LOCATION: Rear lane west of Evergreen Avenue; Refer to Figure 1				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)		SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			ASPHALT					
			CLAY - low plastic, silty, sandy, gravelly, brown, firm, moist ... medium to coarse grained gravel increased below 0.6 m depth			S1		
1						S2		
			GRAVEL - meduim to coarse grained, clayey, moist to very moist			S3		
2						S4		
						S5		
						S6		
3			End of Borehole at 2.8 m depth Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT164504.100. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole was open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					
4								
5								

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MS	COMPLETION DEPTH: 2.80 m
	REVIEWED BY: JL	COMPLETION DATE: 14/7/16
	Page 1 of 1	

BHLOGS.GPJ 16/07/25 10:27 AM (BOREHOLE LOG)

PROJECT: Waterton Townsite Street Works		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-13	
CLIENT: Public Works & Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT164504.100	
LOCATION: Rear lane west of Evergreen Avenue; Refer to Figure 1				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input checked="" type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)		SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			ASPHALT					
			CLAY - low plastic, silty, sandy, gravelly, brown, firm, moist ... medium to coarse grained gravel increased below 0.5 m depth					
1						S1		
						S2		
						S3		
2						S4		
			GRAVEL - meduim to coarse grained, clayey, moist to very moist			S5		
						S6		
3			End of Borehole at 3 m depth					
			Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT164504.100. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole was open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					
4								
5								

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MS	COMPLETION DEPTH: 3.00 m
	REVIEWED BY: JL	COMPLETION DATE: 14/7/16
	Page 1 of 1	

BHLOGS.GPJ 16/07/25 10:27 AM (BOREHOLE LOG)

PROJECT: Waterton Townsite Street Works		DRILLER: Chilako Drilling Services		BOREHOLE NO: BH16-14	
CLIENT: Public Works & Government Services Canada		DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA		PROJECT NO: LT164504.100	
LOCATION: Rear lane west of Evergreen Avenue; Refer to Figure 1				ELEVATION:	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube <input type="checkbox"/> No Recovery <input checked="" type="checkbox"/> SPT Test (N) <input type="checkbox"/> Grab Sample <input type="checkbox"/> Split-Pen <input type="checkbox"/> Core			
BACKFILL TYPE		<input type="checkbox"/> Bentonite <input type="checkbox"/> Pea Gravel <input type="checkbox"/> Slough <input type="checkbox"/> Grout <input type="checkbox"/> Drill Cuttings <input type="checkbox"/> Sand			

Depth (m)		SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			ASPHALT					
			CLAY - low plastic, silty, sandy, gravelly, brown, firm, moist					
			... medium to coarse grained gravel increased below 0.65 m depth			S1		
1						S2		1
						S3		
2			GRAVEL - meduim to coarse grained, clayey, moist to very moist			S4		2
						S5		
3			End of Borehole at 3 m depth			S6		3
			Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report LT164504.100. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole was open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					
4								4
5								

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: MS	COMPLETION DEPTH: 3.00 m
	REVIEWED BY: JL	COMPLETION DATE: 14/7/16
	Page 1 of 1	

BHLOGS.GPJ 16/07/25 10:27 AM (BOREHOLE LOG)

EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of field investigation and subsequent laboratory testing are described in these pages.

It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site.

TEST DATA

Data obtained during the field investigation and from laboratory testing are shown at the appropriate depth interval.

Abbreviations, graphic symbols, and relevant test method designations are as follows:

*C	Consolidation test	*ST	Swelling test
D _R	Relative density	TV	Torvane shear strength
*k	Permeability coefficient	VS	Vane shear strength
*MA	Mechanical grain size analysis and hydrometer test	w	Natural Moisture Content (ASTM D2216)
N	Standard Penetration Test (CSA A119.1-60)	w _l	Liquid limit (ASTM D 423)
N _d	Dynamic cone penetration test	w _p	Plastic Limit (ASTM D 424)
NP	Non plastic soil	E _f	Unit strain at failure
pp	Pocket penetrometer strength (kg/cm ²)	γ	Unit weight of soil or rock
*q	Triaxial compression test	γ _d	Dry unit weight of soil or rock
q _u	Unconfined compressive strength	ρ	Density of soil or rock
*SB	Shearbox test	ρ _d	Dry Density of soil or rock
SO ₄	Concentration of water-soluble sulphate	C _u	Undrained shear strength
		→	Seepage
		▼	Observed water level

* The results of these tests are usually reported separately

Soils are classified and described according to their engineering properties and behaviour.

The soil of each stratum is described using the Unified Soil Classification System¹ modified slightly so that an inorganic clay of "medium plasticity" is recognized.

The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual².

Relative Density and Consistency:

Cohesionless Soils		Cohesive Soils		
Relative Density	SPT (N) Value	Consistency	Undrained Shear Strength c _u (kPa)	Approximate SPT (N) Value
Very Loose	0-4	Very Soft	0-12	0-2
Loose	4-10	Soft	12-25	2-4
Compact	10-30	Firm	25-50	4-8
Dense	30-50	Stiff	50-100	8-15
Very Dense	>50	Very Stiff	100-200	15-30
		Hard	>200	>30

Standard Penetration Resistance ("N" value)

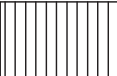



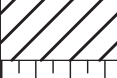

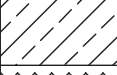

The number of blows by a 63.6kg hammer dropped 760 mm to drive a 50 mm diameter open sampler attached to "A" drill rods for a distance of 300 mm.

¹ "Unified Soil Classification System", Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S. Army, Vol. 1 March 1953.

² "Canadian Foundation Engineering Manual", 4th Edition, Canadian Geotechnical Society, 2006.

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	COLOUR CODE	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (LITTLE OR NO FINES)	GW		RED	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			GP		RED	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY GRAVELS (WITH SOME FINES)	GM		YELLOW	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12 %	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			GC		YELLOW	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (LITTLE OR NO FINES)	SW		RED	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			SP		RED	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY SANDS (WITH SOME FINES)	SM		YELLOW	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12 %	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			SC		YELLOW	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7

FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLEGIBLE ORGANIC CONTENT	$W_L < 50\%$	ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		$W_L < 50\%$	MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDS OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLEGIBLE ORGANIC CONTENT	$W_L < 30\%$	CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		$30\% < W_L < 50\%$	CI		GREEN- BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		$W_L > 50\%$	CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$W_L < 50\%$	OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		$W_L > 50\%$	OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY	
	HIGHLY ORGANIC SOILS			Pt		ORANGE	PEAT AND OTHER HIGHLY ORGANIC SOILS

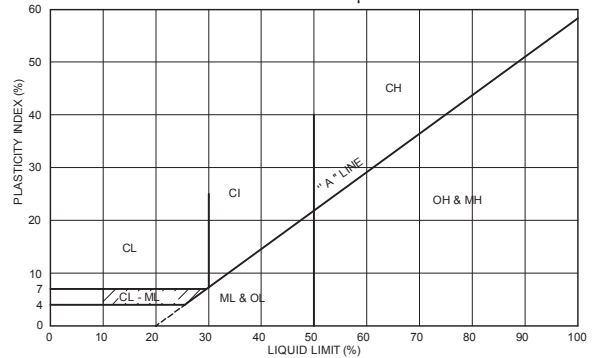
SPECIAL SYMBOLS

LIMESTONE		OILSAND	
SANDSTONE		SHALE	
SILTSTONE		FILL (UNDIFFERENTIATED)	

SOIL COMPONENTS

FRACTION	U.S. STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
	PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	76mm	19mm	35-50	AND
	19mm	4.75mm		
SAND	4.75mm	2.00mm	20-35	Y/EY
	2.00mm	425µm		
	425µm	75µm	10-20	SOME
	75µm			
FINES (SILT OR CLAY BASED ON PLASTICITY)	75µm		1-10	TRACE

PLASTICITY CHART FOR SOILS PASSING 425 µm SIEVE



NOTES:

- ALL SIEVE SIZES MENTIONED ON THIS CHART ARE U.S. STANDARD A.S.T.M. E.11
- COARSE GRAIN SOILS WITH 5 TO 12% FINES GIVEN COMBINED GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH CLAY BINDER BETWEEN 5 AND 12% FINES.

OVERSIZED MATERIAL

ROUNDED OR SUBROUNDED: COBBLES 76mm TO 200mm BOULDERS > 200mm	NOT ROUNDED: ROCK FRAGMENTS > 76mm ROCKS > 0.76 CUBIC METRE IN VOLUME
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amec foster wheeler

